

No. 652,074.

Patented June 19, 1900.

G. M. BISHOP & F. J. HUGHES.
SMOKE CONSUMER AND STEAM GENERATOR.

(No Model.)

(Application filed Sept. 9, 1899.)

2 Sheets—Sheet 1.

Fig. 1.

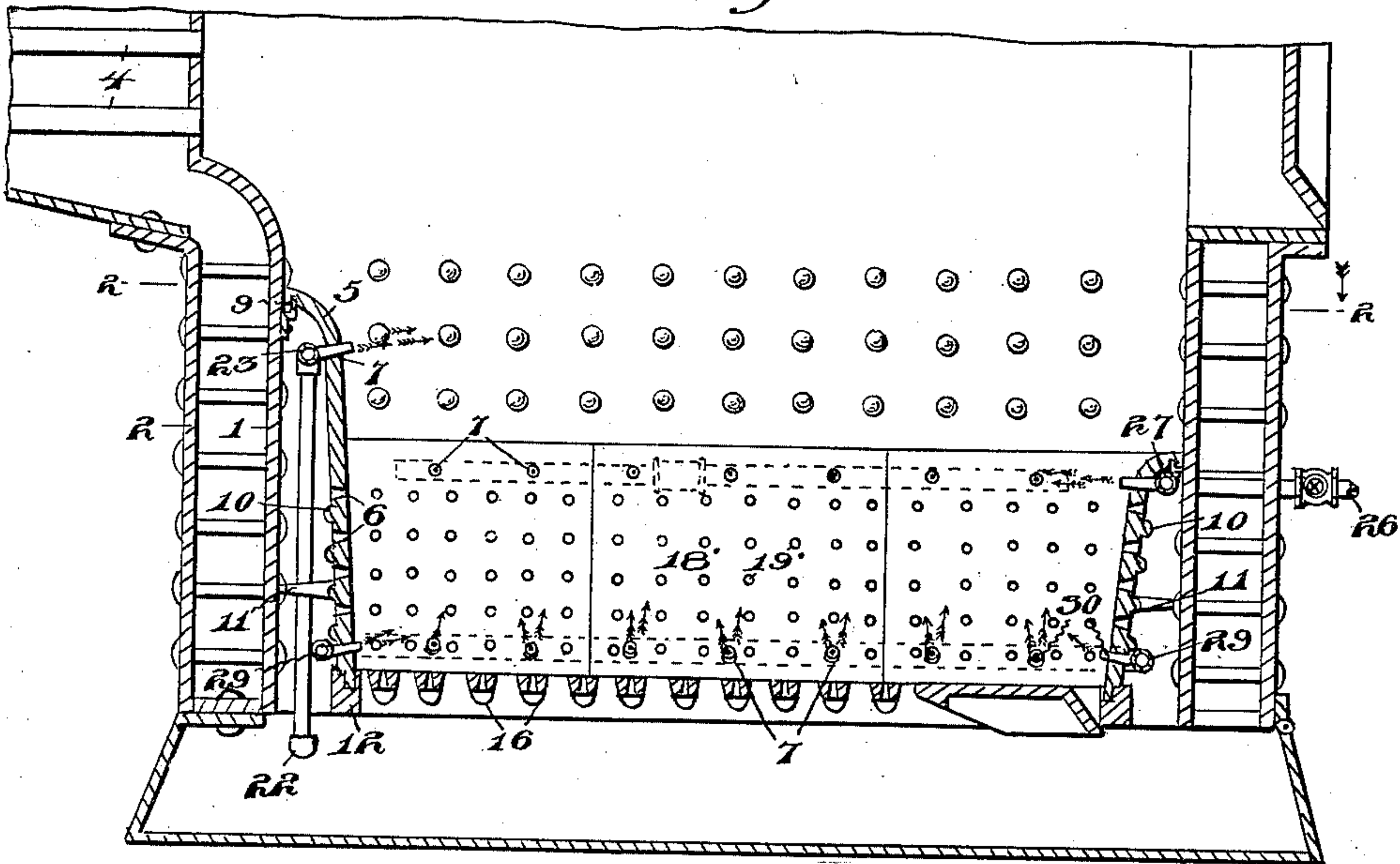
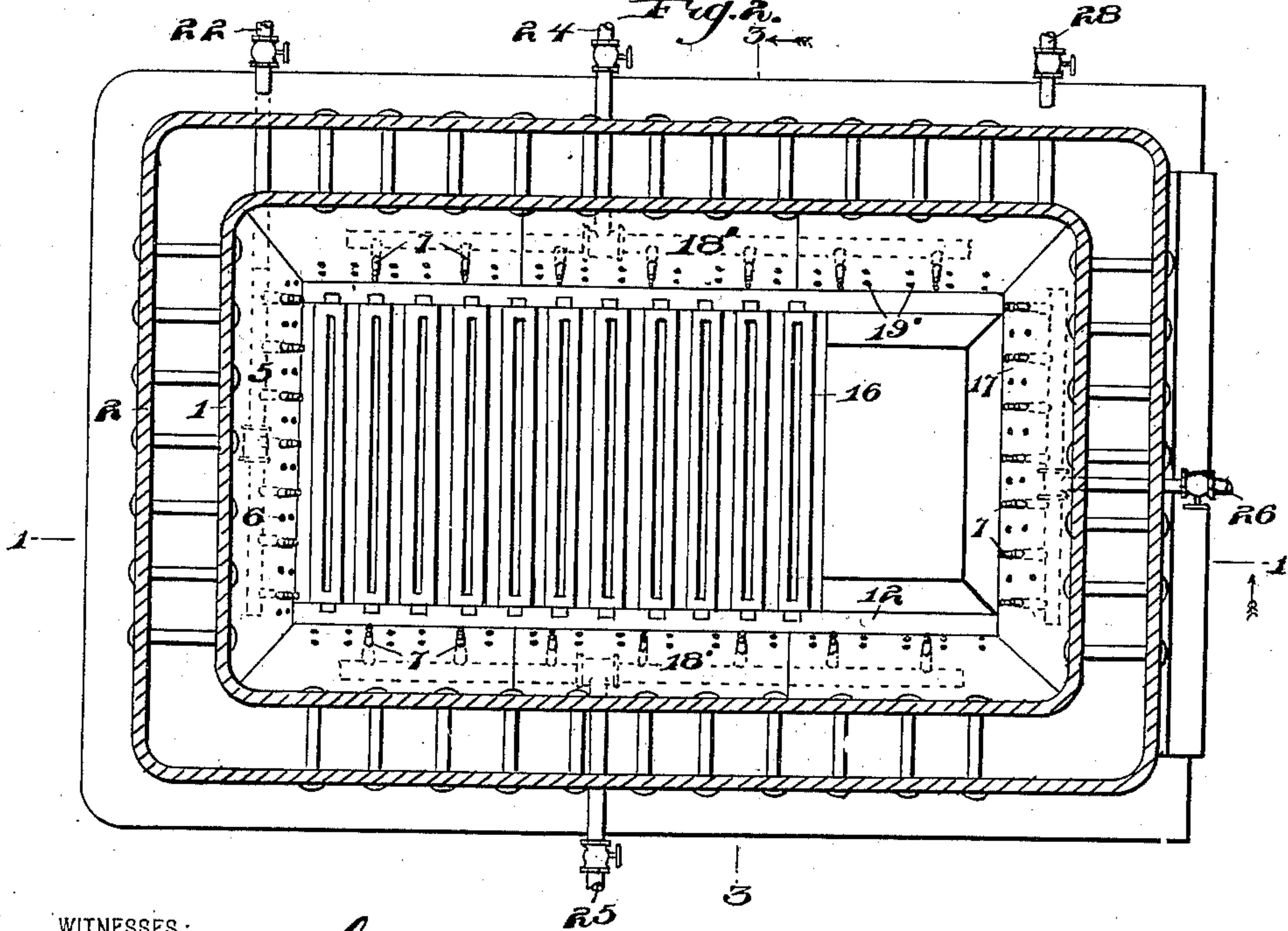


Fig. 2.



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No. 652,074.

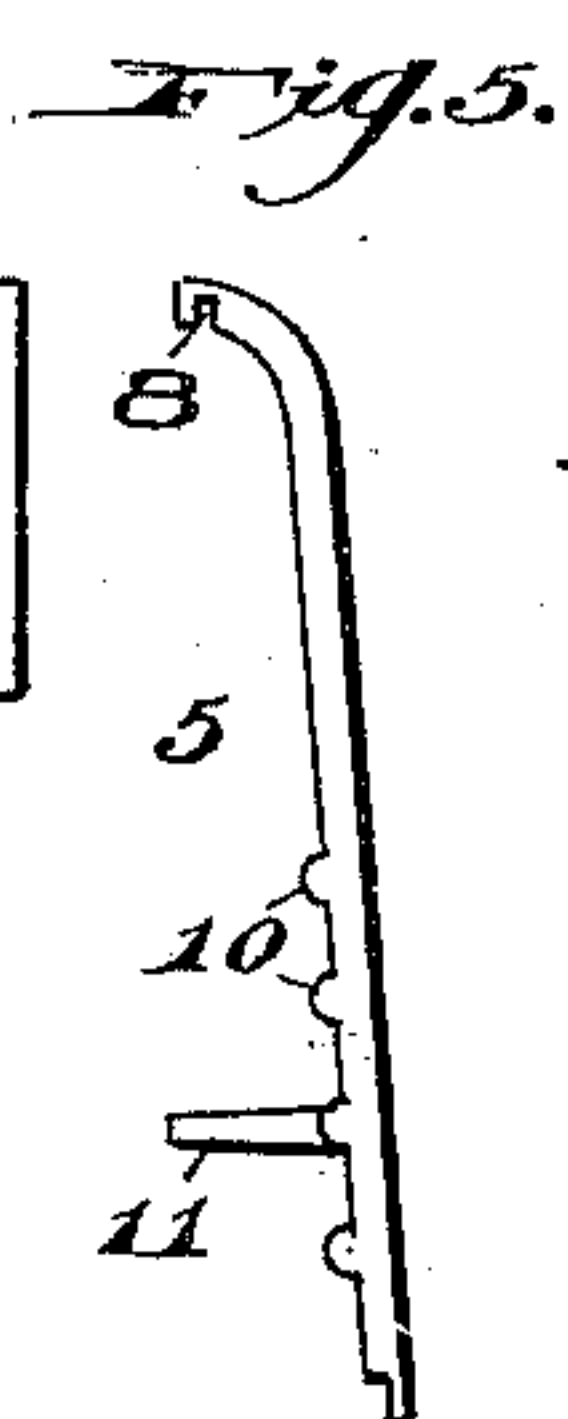
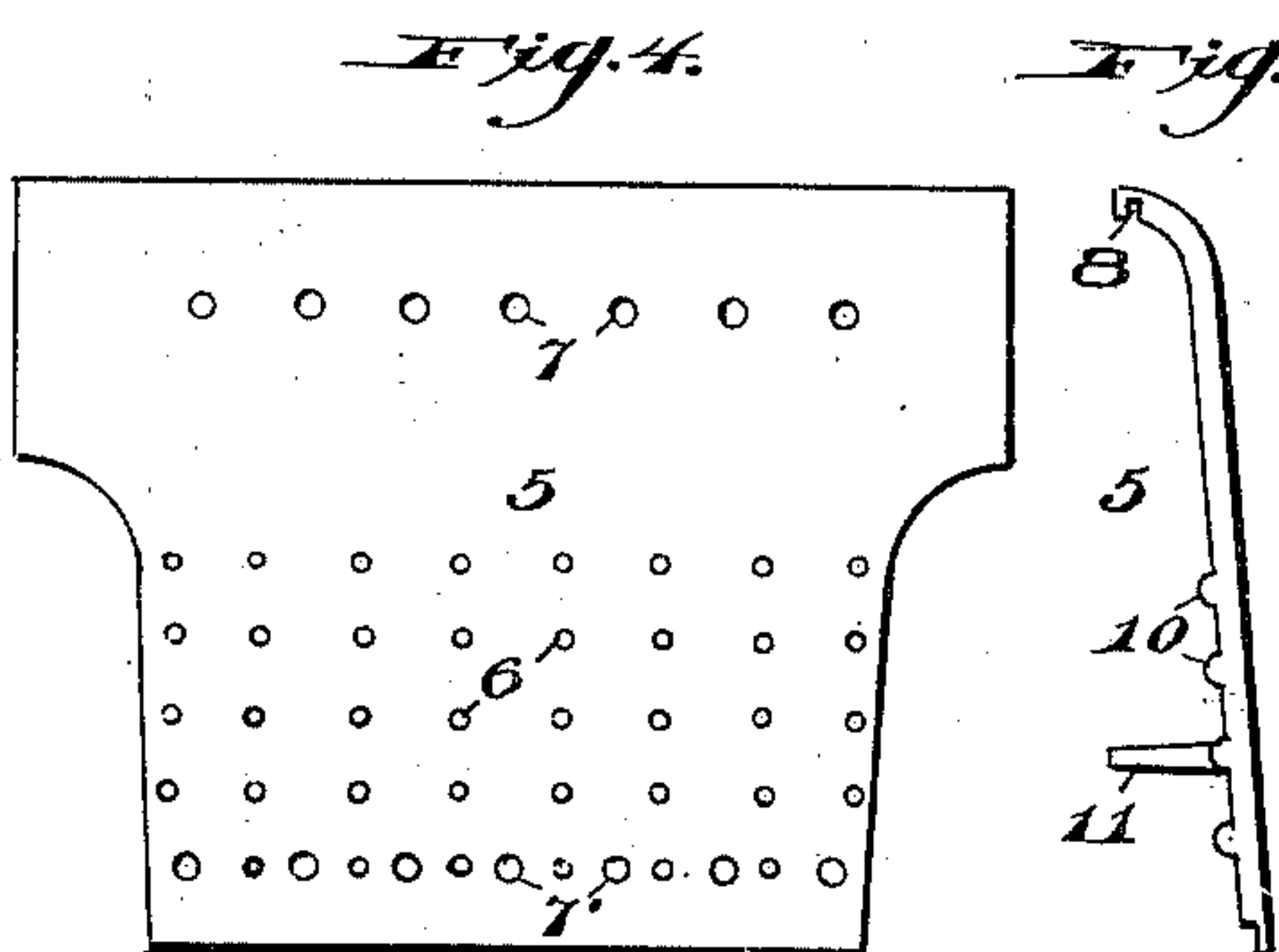
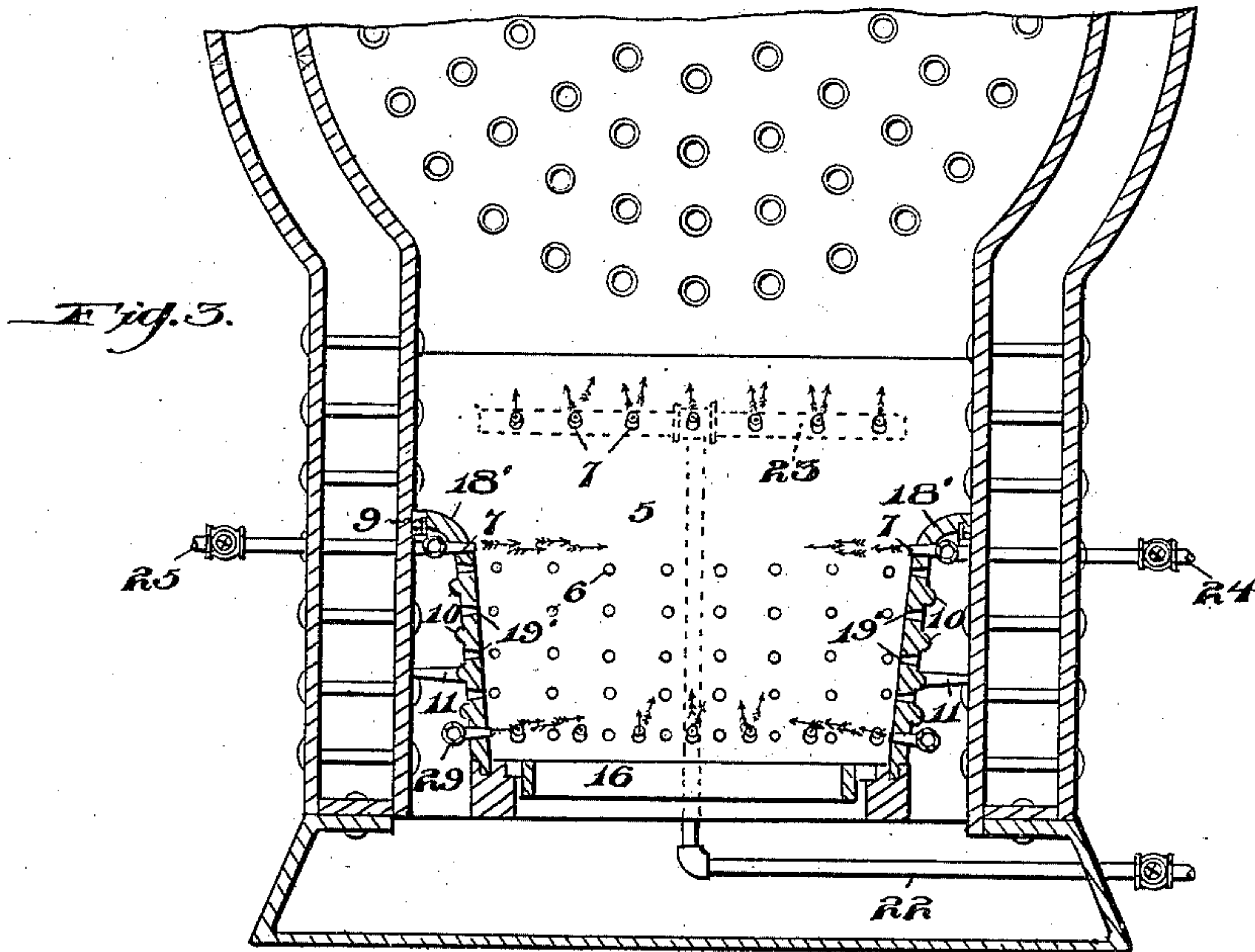
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2 Sheets—Sheet 2.



UNITED STATES PATENT OFFICE.

GEORGE M. BISHOP AND FRANK J. HUGHES, OF PITTSBURG, PENNSYLVANIA.

SMOKE-CONSUMER AND STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 652,074, dated June 19, 1900.

Application filed September 9, 1899. Serial No. 729,924. (No model.)

To all whom it may concern:

Be it known that we, GEORGE M. BISHOP and FRANK J. HUGHES, citizens of the United States of America, residing at No. 2144 Second
5 avenue, Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Smoke-Consumers and Steam-Generators, of which the following is a specification, reference being
10 had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in smoke-consumers and steam-generators, and has for one object to provide novel and effective means within the
15 fire-box of either stationary engines or locomotives for igniting and consuming the hydrogen gases and the hydrocarbon that arises from the fuel and to increase the temperature, so as to obtain a greater efficiency from the
20 boiler.

A further object of the invention is to construct a furnace which will utilize all the combustibles contained in the fuel, thereby increasing the temperature and at the same
25 time saving a considerable amount of fuel.

A further object of the invention is to construct a furnace in which the natural tendency of the smoke or combustibles to be drawn outward through the flues before they can be
30 consumed will be restrained and these combustibles held within the furnace until such time as they may be consumed without in any manner interfering with the natural draft of the furnace.

Briefly described our invention consists in the placing within the furnace of one or more perforated plates, preferably one at each side of the furnace, with an air-space between these plates which is in communication with
40 the ash-pit or the outside atmosphere. The draft within the furnace causes the air to be drawn within this passage and through the perforations in the plates into the furnace, and as it must necessarily pass through the
45 fire it is heated to a very high degree before being mixed with the combustibles within the furnace. We also surround the furnace with a steam-pipe through which hot steam is fed from the dome of the boiler into the
50 furnace, this steam mixing with the hot air within the furnace and sufficiently raising the temperature therein to ignite the hydro-

gen gases and the hydrocarbon and consume the same.

We preferably provide independent feed- 55 pipes for the steam, so that the same may be fed through the sides or at the front or back of the furnace separately or in unison, as desired, and preferably feed the steam from the dome of the boiler, as the steam contained 60 therein is hotter and drier, being more largely freed from its moisture than that in the boiler proper.

Various features of construction enter into our invention, and these features will be here- 65 inafter more specifically described and then particularly pointed out in the appended claims, and in describing the invention in detail reference will be had to the accompanying drawings, forming a part of this specifica- 70 tion, and wherein like numerals of reference will be employed to designate similar parts throughout the several views, in which—

Figure 1 is a vertical sectional view of a furnace constructed in accordance with our 75 invention. Fig. 2 is a horizontal sectional view of the furnace, taken on the line 2 2 of Fig. 1. Fig. 3 is a vertical sectional view of the furnace, taken on the line 3 3 of Fig. 2. Fig. 4 is a plan view of the perforated plate 80 which is placed against the rear wall of the furnace. Fig. 5 is an end view of the same. Fig. 6 is a detail plan view of the plate arranged at the front of the furnace. Fig. 7 is an end view of the same. Fig. 8 is a detail 85 plan view of one section of the side plates. Fig. 9 is an end view of the same. Fig. 10 is a sectional view of a portion of one of the perforated plates and of the furnace-wall, showing means for securing the plates to the 90 wall. Fig. 11 is a detail view in perspective of one of the strips secured to the furnace-wall for fastening the perforated plates thereto. Fig. 12 is a detail view in perspective of a part of the support in which the perforated 95 plates rest at their lower ends and which also acts as a support for the grate-bars.

In the accompanying drawings we have shown the furnace constructed of the ordinary inner walls 1 and outer walls 2, bolted 100 together by bolts or rivets in the usual manner, these parts being shown in order to clearly illustrate our invention and to show the position of the perforated plates, the

steam-feeding pipes, and other parts entering into the invention.

Arranged adjacent to the back wall of the furnace, which wall is directly in front of the flues 4, is a plate 5, which is provided in its lower portion with a series of perforations 6 and near its upper end with a series of perforations 7, the latter being preferably arranged in alinement and adapted to receive the nipples connected to the steam-feeding pipe. This plate 5 is curved at its upper end, the upper portion thereof being at substantially right angles to the plate proper in order that the upper edge may fit neatly with and rest against the inner walls 1, and it is provided on the under face of this turned-over or curved portion with a longitudinally-extending recess 8, which is adapted to receive a strip 9, bolted, riveted, or otherwise firmly secured to the inner walls 1 for holding the plate in its position. A convenient and practical form of construction for this strip is shown in detail in Fig. 11 of the drawings, in which it is centrally shouldered longitudinally of the strip, so that the upper portion thereof will set out a slight distance from the inner walls 1 and the lower half thereof will engage the said walls for bolting, riveting, or otherwise securing the same thereto. This plate 5 is set at a slight incline within the furnace, the space between the lower end of the same and the flue-sheet being slightly greater than at the top of the plate, and in order to increase the life of the plate we preferably construct the same with ridges 10, and we also provide the plate on its rear face with one or more studs or pins 11, which are adapted to engage the inner wall and act as a brace for the plate. At its lower end the plate is supported by a bearing-bar 12, extending around the inner walls of the furnace, at the bottom thereof, and provided with a longitudinal groove 14, in which the lower edge of this plate 5 rests and is held against displacement at this lower end. This bar 12 is preferably constructed with the seats 15 to receive the ends of the grate-bars 16, so that the bar may be used for supporting these grate-bars, as well as a support and retaining means for the plate.

In order to feed the steam into the furnace at the rear thereof, or through this plate 5, which is in front of the flues, both at or near the top of the plate, at a point above the fire, and at or near the bottom of the plate, which is at a point within or under the fire, we preferably provide the plate near its lower end with a horizontal line of openings 7', which receive the feed-nipples connected to a separate feed-line than that which feeds the steam through the openings 7. This plate 5 is made of a greater height than the perforated plates which are arranged at the sides and at the front of the furnace in order that the steam may be fed at a point above the fire directly in front of the flues, so as to force the smoke or combustibles toward the front of the fur-

nace, directly over the bed of the fire, in order that they may be consumed and be prevented from being drawn by the natural draft directly into the flues.

The front plate 17 is of substantially the same shape as the plate 5, with the exception that it is not necessary to construct or extend the plate to as great a height as the plate 5. It is supported at its upper and lower end in the same manner as heretofore described for the plate 5, being provided with the strengthening-ribs 10, the bracing studs or pins 11, and having the longitudinal groove 8 to receive the strip 9, and is positioned in the furnace at the same relative angle. This plate is likewise provided with an upper and a lower row of apertures 18 and 19, respectively, to receive the nipples of the separate feed-lines.

The perforated plates which are placed along the sides of the furnace are preferably constructed in a series of sections, as these plates are more liable to injury by the action of the intense heat within the furnace, and may therefore be more easily and cheaply renewed than were they constructed in one piece. The sections from which these side plates are formed are indicated by the reference-numeral 18', each section being provided with a series of perforations 19' to admit the passage of the air into the furnace, as is done in the plates 5 and 17. They are similarly constructed to these plates 5 and 17, having the curved or turned-over upper ends, the strengthening-ribs, and the bracing-studs, and are supported in the same manner—namely, by the strip 9 at the upper end and by the bearing-bar 12 at their base, this bearing-bar 12 being in the form of a rectangular open frame extending entirely around the furnace, so as to form a support for the lower ends of all the perforated plates, and the strip 9 being also in the form of a rectangular-shaped open frame extending entirely around the furnace at a suitable position to be engaged by the plates in the manner described. Each section of the side plates is provided with the upper and lower openings 20 and 21, respectively, to receive the independent nipples of the steam-feed lines.

In order to introduce hot steam into the furnace and thoroughly mix the same with the hot air introduced through the perforated plates and to introduce this steam at different points within the furnace, we provide a number of independent feed-lines, the accompanying drawings showing four lines. Each line is preferably connected to the dome of the boiler in order that hot and dry steam may be obtained, the line 22 being carried underneath the furnace and upwardly between the inner flue-sheet and the plate 5, with a branch 23 mounted thereon, and provided with as many nipples as there are openings 7 in the plate 5, into which openings the nipples project. This line of nipples, it will be observed, is considerably above the top of the side plates and is located directly below

the inlet to the flues in order that the steam as injected into the furnace through the nipples will force the smoke and combustibles toward the front of the furnace, directly over the fire-bed, and the temperature being considerably raised by the commingling of the hot steam with the hot air these combustibles are consumed during their passage over the bed of the fire, eliminating the smoke and utilizing all the elements of the fuel.

In order to inject the hot steam into the furnace at the sides, we provide independent steam-lines 24 and 25, respectively, which are carried through the sides of the furnace at a point opposite to the openings 20, with branches 26 mounted thereon, and provided with as many nipples to engage in the openings 20 as there are openings in these side plates. The steam is likewise fed at the front of the furnace through an independent line 26, that is carried through the front of the furnace near the fire-box door and opposite to the openings 18, with a branch 27 connected thereto, and provided with as many nipples to project into the furnace as there may be openings therefor in the plate 17. The steam injected through the line 22 is introduced into the furnace above the bed of the fire, while the steam injected at the sides is preferably introduced at a point directly on top of the bed of the fuel.

In order to also introduce steam directly into the fire, we provide an independent feed-line 28, which is carried through one side of the furnace at any suitable point and is connected to a substantially rectangular-shaped line 29, extending entirely around the perforated plates within the passage-way between the same and the inner flue-sheet, this line or pipe 29 carrying nipples 30, which project into the lower openings provided therefor in the perforated plates. A suitable cock or valve is arranged on each of these lines, so that they may be used separately or in unison, if desired.

We desire to call attention to the fact that by flanging the tops of the perforated plates so that they will fit against the inner walls of the furnace at their top and securing the plates thereto in the manner described the air passing into the passage-way between the perforated plates and the inner walls is drawn into the furnace through the perforations in the plate, so as to be thoroughly heated before being mixed with the steam. By reason of the draft within the furnace the natural tendency of the smoke and combustibles is to rush toward the flues; but by the injection of the steam into the furnace through the plate 5 near its top it is forced into contact with the smoke or combustibles and carries the same back onto the fire, where it may be consumed, and by the arrangement of the perforated plates as described and of the steam-lines to inject the steam at the sides and front of the furnace we counteract any effect which the injection of steam through

the line 22 might have upon the draft. The arrangement of these plates also affords a great protection to the fire-box, as well as preventing the flues from becoming clogged with cinders or soot and the emitting of sparks through the smoke-stack, as the smoke or combustibles are entirely consumed before reaching the flues. It will be observed, of course, that in practice on a locomotive we could attach a pipe to the exhaust-pipe in the smoke-box and bring some of the exhaust-steam into the furnace, which would tend to increase the temperature and aid in consuming the smoke.

Although we have shown and described a furnace having a natural draft, it will of course be observed that the device could be employed as readily in connection with such furnaces as are constructed for forced draft, where it is required to introduce a greater quantity of air into the fire. It will also be observed that these plates may, if desired, be provided with a covering of asbestos or perforated fire-bricks to protect the same, or they may be cast with a water-jacket therein and connect this jacket by a pipe to the boiler, so as to obtain a circulation of water through the plates, practically making the same when in this form a part of the boiler and increasing the steam-generating capacity of the latter.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a furnace, the combination with the fire-box and the support arranged at the bottom thereof upon which is mounted the grate-bars, of a series of perforated plates arranged within said fire-box and resting upon said support, one of the said plates being of greater height than the others and which is arranged at the front of the flues, means secured to the inner walls for connecting the said plates thereto, a feed-line connected to the boiler and adapted to introduce steam into the furnace through the said larger plate at the point above the fire directly in front of the flues, and a series of feed-lines for introducing steam into the furnace through the remainder of the said perforated plates, substantially as described.

2. In a furnace, the combination with the fire-box and a support arranged at the bottom thereof upon which is mounted the grate-bars, of a series of inclined perforated plates arranged within said furnace and extending entirely around said fire-box and having their upper ends converging to the walls of the furnace, means secured to the walls and adapted to engage the converging ends of the said plates for connecting the same thereto, means formed integral with one face of the said plates for bracing the same and adapted to engage the walls, a feed-line connected to the boiler and adapted to introduce steam into the furnace through one of the said plates at a point above the fire and directly in front of the flues, and a series of feed-lines for intro-

ducing steam into the furnace through the remainder of the said perforated plates, substantially as described.

3. In a furnace, the combination with the
5 fire-box arranged at the inner end of the boiler and a support arranged at the bottom of the fire-box for supporting the grate-bars, of a series of inclined perforated plates formed in sections arranged within said furnace and
10 surrounding said fire-box and having their upper end converging to the inner walls of the furnace, one of the said plates of the series being of greater height than the other plates of the series and arranged in close
15 proximity to the end of the boiler-flues, means secured to the inner walls and adapted to engage the converging end of each of the said

plates for connecting the same thereto, means formed integral with one face of the said plates for bracing the same and engaging the
20 inner walls, a feed-line connected to the boiler and adapted to introduce steam through said larger plate at a point above the fire and directly in front of the boiler-flues, and a series of feed-lines for introducing steam into
25 the furnace through the remainder of said perforated plates, substantially as described.

In testimony whereof we affix our signatures in the presence of two witnesses.

GEORGE M. BISHOP.
FRANK J. HUGHES.

Witnesses:

JOHN NOLAND,
E. W. ARTHUR.