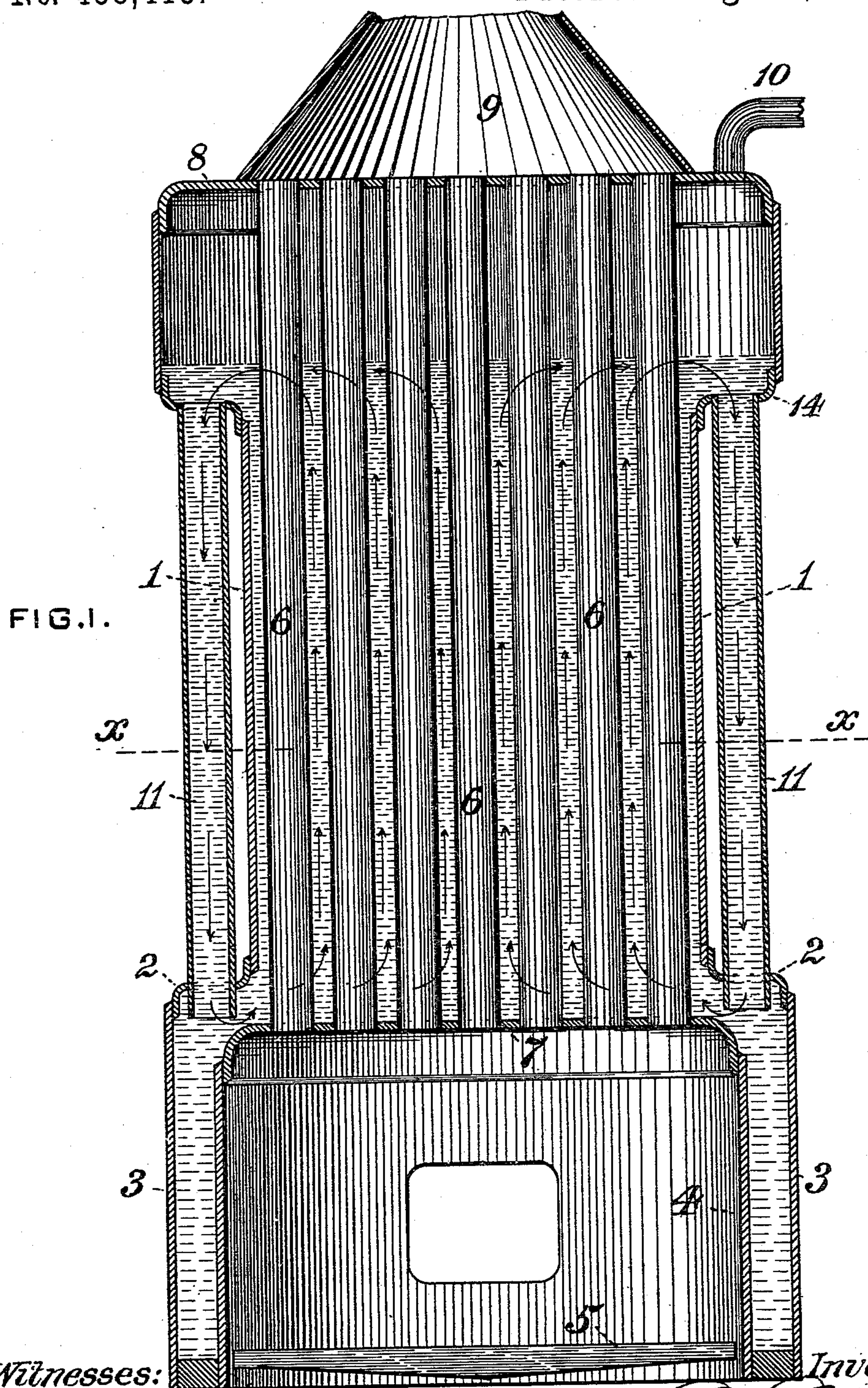


4 Sheets—Sheet 1.

No. 458,413.

Patented Aug. 25, 1891.



Witnesses:

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(No Model.)

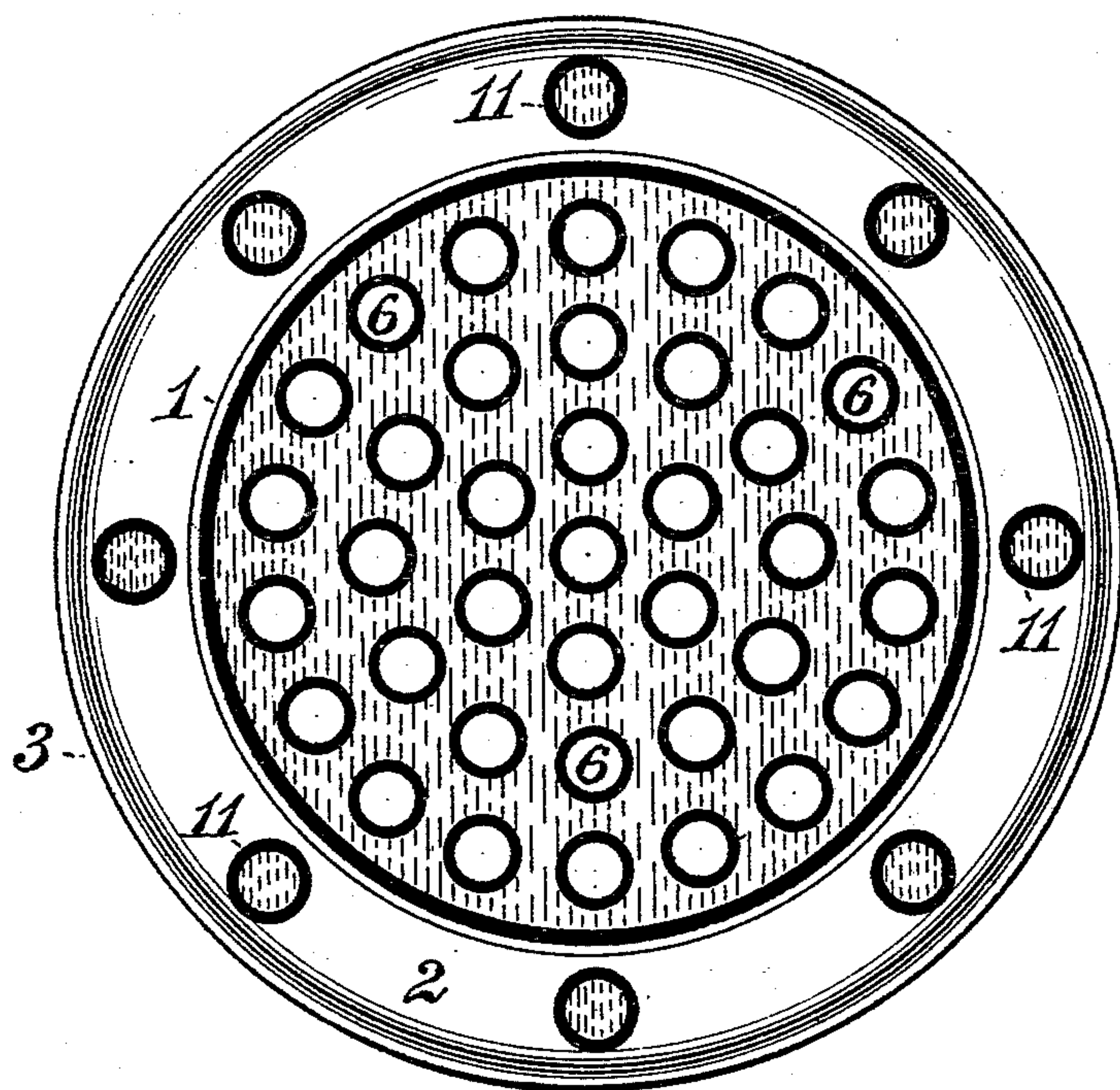
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B. BRAZELLE.
STEAM BOILER.

No. 458,413.

Patented Aug. 25, 1891.

FIG. 2.



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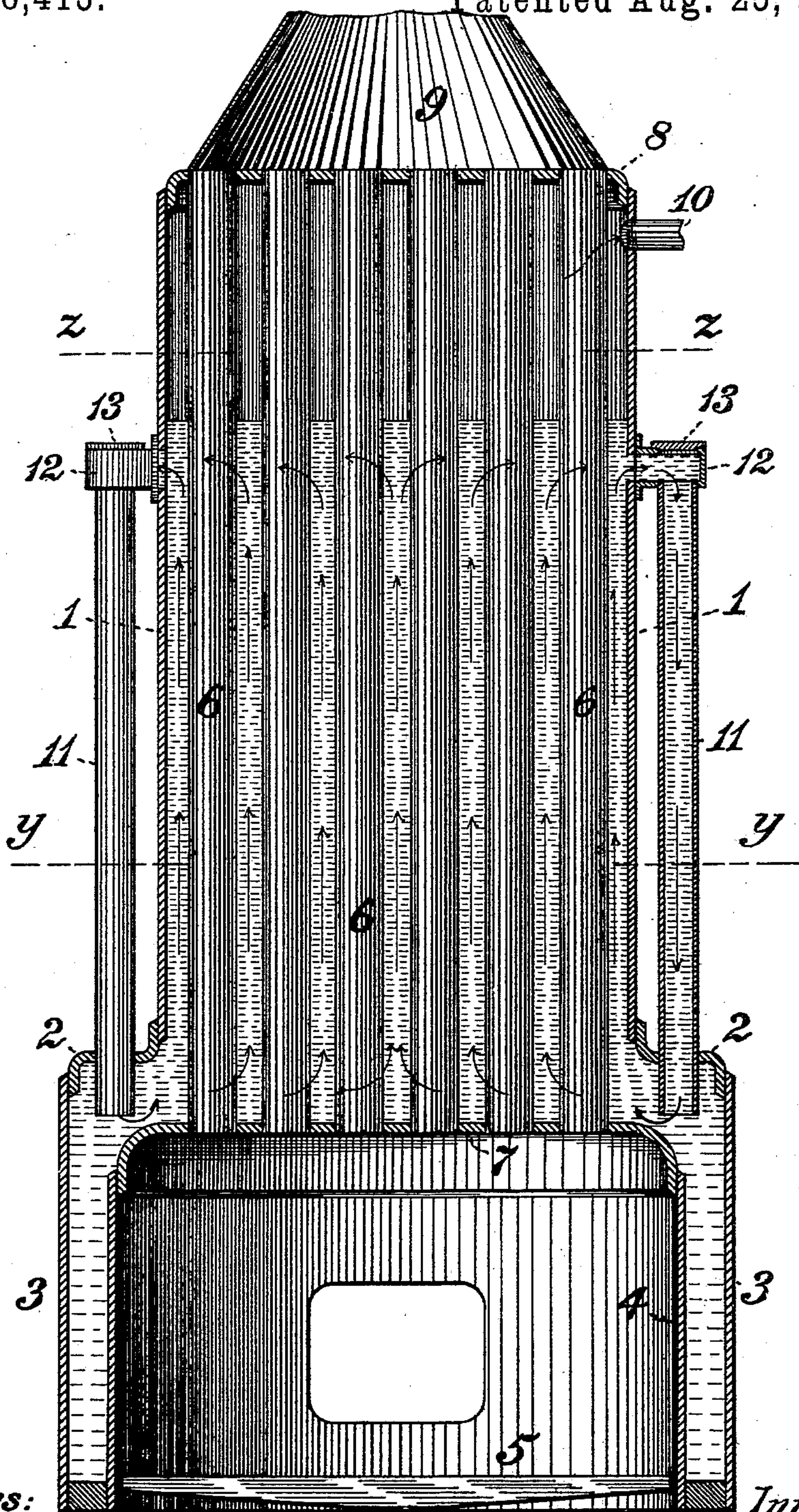
4 Sheets—Sheet 3.

B. BRAZELLE.
STEAM BOILER.

No. 458,413.

Patented Aug. 25, 1891.

FIG. 3.



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B. BRAZELLE.
STEAM BOILER.

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FIG. 4.

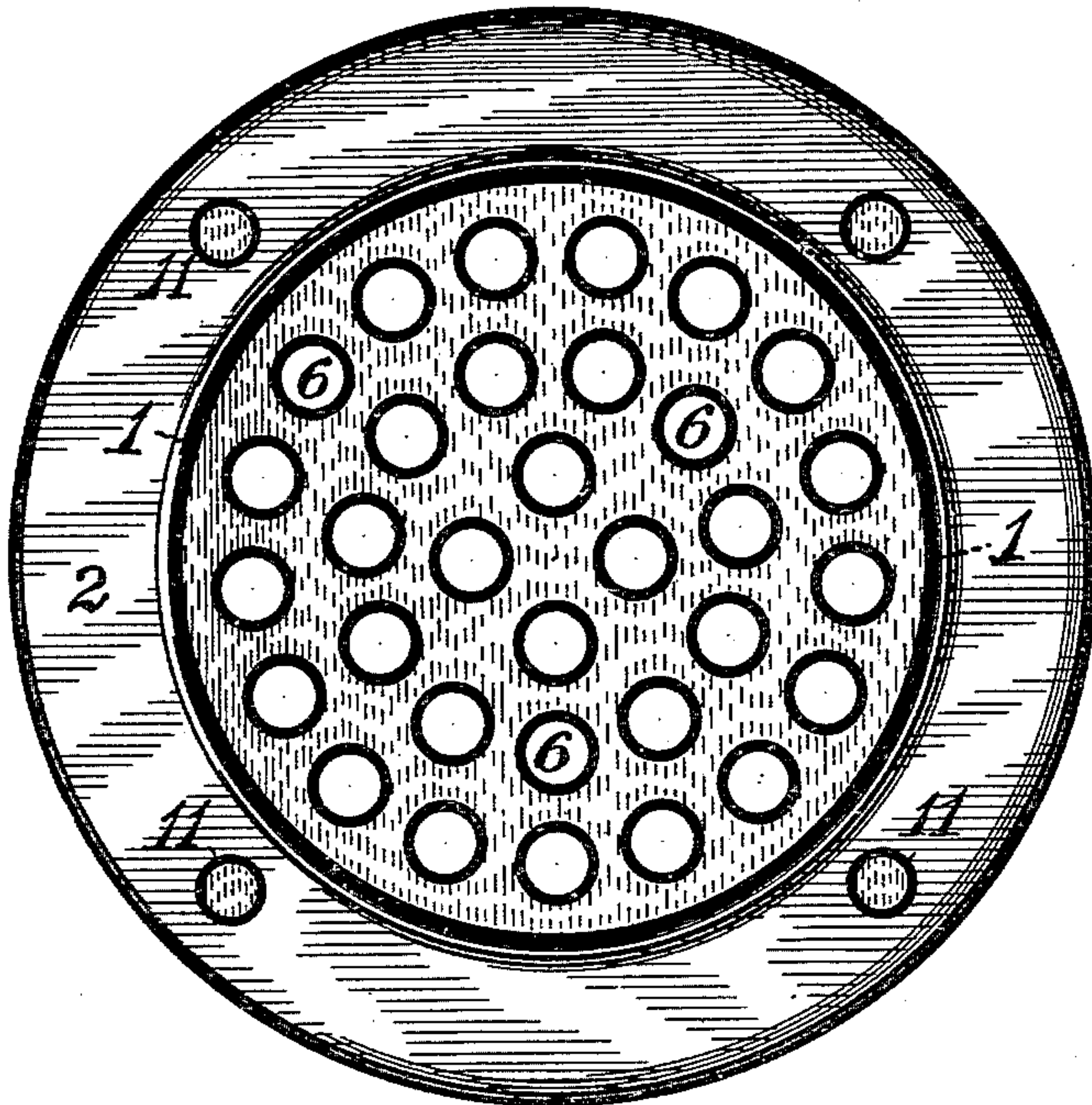
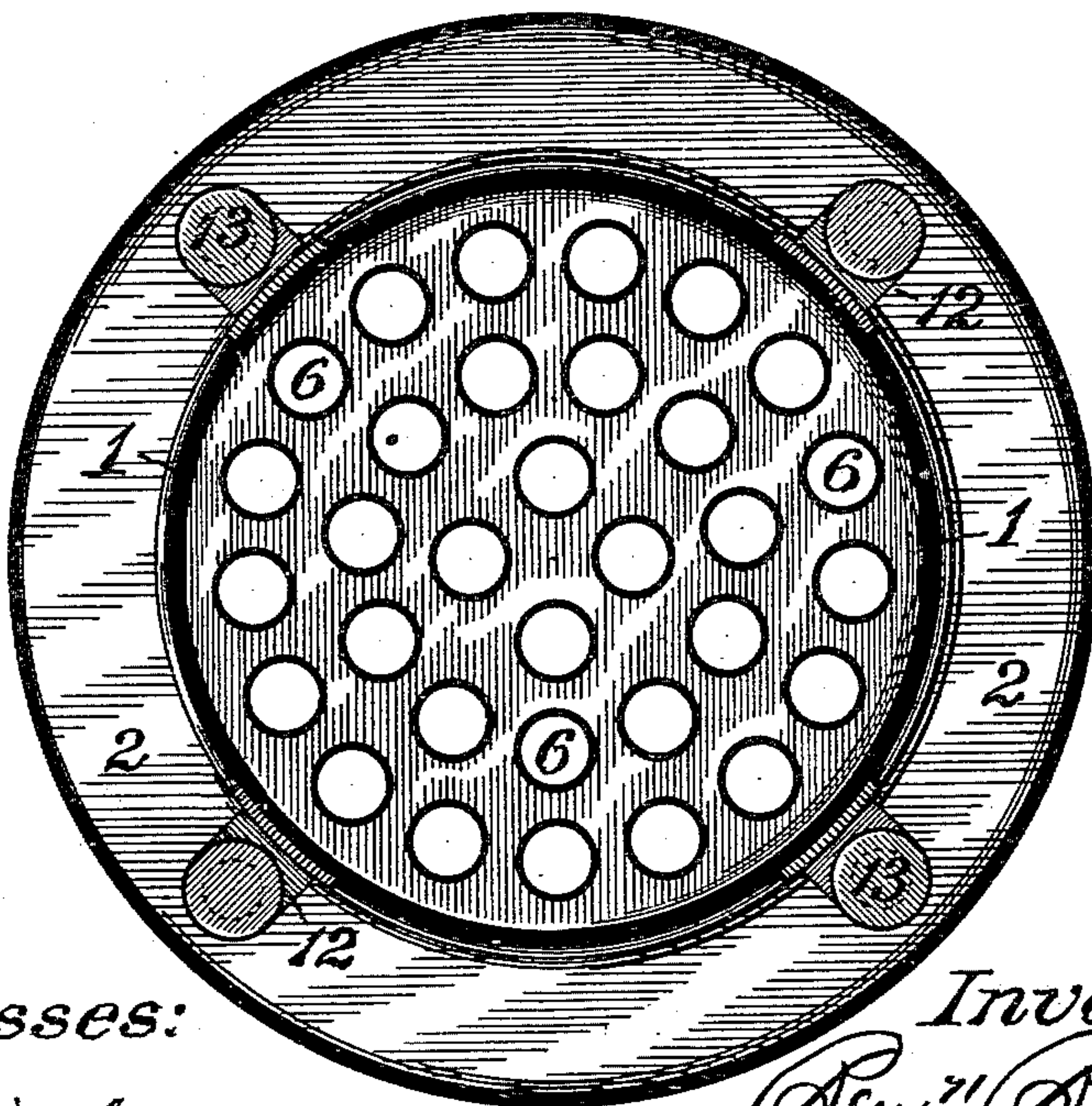


FIG. 5.



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UNITED STATES PATENT OFFICE.

BENJAMIN BRAZELLE, OF ST. LOUIS, MISSOURI.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 458,413, dated August 25, 1891.

Application filed May 20, 1889. Serial No. 311,433. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN BRAZELLE, of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Steam-Boilers, of which improvement the following is a specification.

The object of my invention is to facilitate and expedite the generation of steam by the provision of simple and effective means for causing the rapid and continuous circulation of water in a steam-boiler over the surfaces to which heat is applied.

To this end my invention, generally stated, consists in the combination of a shell, an internal fire-box, a series of fire-tubes passing longitudinally through the shell, and a series of external circulating-tubes extending from the upper portion of the water-space to and opening vertically and directly into the fire-box casing.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical longitudinal central section through a steam-boiler embodying my invention; Fig. 2, a horizontal section through the same at the line $x x$ of Fig. 1; Fig. 3, a vertical longitudinal section through a boiler, illustrating a modified form of connection of the upper ends of the circulating-tubes; and Figs. 4 and 5, horizontal sections through the same at the lines $y y$ and $z z$, respectively, of Fig. 3.

My invention is herein illustrated as applied in a boiler of the vertical tubular type having a cylindrical shell 1, which is connected at its lower end by an annular sheet 2 to a fire-box casing 3 of a diameter greater than that of the main portion of the boiler. An inside fire-box 4, having a suitable grate 5 located near its bottom, is connected in the usual manner to the fire-box casing 3, and a series of fire tubes or flues 6 passes through the boiler from the crown-sheet 7 of the fire-box to the head 8, which closes the opposite end of the boiler, the tubes 6 delivering the products of combustion from the fire-box into a smoke-box or uptake 9, to which a proper stack or discharge-flue is connected.

While I have shown and described a multiple series of fire-tubes as being the preferred construction, it will be obvious that a single

flue or flues of larger diameter may, if preferred, be employed, and would constitute a mechanical equivalent. A steam-supply pipe 10 leads from the upper portion of the steam-space of the boiler to a desired point of delivery.

In order to produce and maintain a continuous and rapid circulation of water in the boiler, and thereby to correspondingly promote and expedite the generation of steam therein by continually presenting different portions of the contained body of water to the heated surfaces of the tubes 6 and crown-sheet 7, I provide a series of circulating-tubes 11, which are located on the outside of the shell 1, their upper ends communicating therewith a short distance below the normal water level line of the boiler, and their lower ends opening into the water-space inclosed by the fire-box casing 3 a short distance below the annular sheet or head 2, by which said casing is connected to the shell. The circulating-tubes pass through the sheet 2, with which they make tight joints to prevent leakage of water, and are extended below the head, as shown, to prevent the entrance of upward currents of water during rapid steam generation.

As shown in Figs. 1 and 2, the circulating-tubes are connected directly to the shell at their upper ends, the shell being enlarged in diameter similarly to the fire-box from the level of the upper ends of the circulating-tubes to the top head 8 of the boiler. The enlarged upper portion of the shell, which incloses the steam-space and affords increased volume therefor, is connected with the main portion of the shell by an annular sheet 14, into which the upper ends of the circulating-tubes are expanded in the usual manner, and through which a direct downward passage for water into the circulating-tubes is afforded, as indicated by the arrows in Fig. 1.

The construction illustrated in Figs. 3 to 5, inclusive, differs from that of Figs. 1 and 2 in the particular that the shell 1 is of uniform diameter above the fire-box casing in lieu of being enlarged at and near its upper end, and the upper ends of the circulating-tubes 11 are connected to the shell below the normal water-level through the intermediation of separate fittings or heads 12, which are provided with

suitable flanges, through which they are bolted or riveted to the shell. The circulating-tubes are secured tightly in openings on the lower sides of the heads, and in order to
 5 admit of the insertion of an expander for setting the tubes opposite openings are formed in the upper sides of the heads, which openings are closed by caps 13.

In operation the heat imparted to the series of fire-tubes 6 by the products of combustion is transmitted to the water, which immediately adjoins the fire-tubes, thereby causing the formation of a series of ascending currents of water, which are rendered rapid
 15 and continuous by the provision of avenues for corresponding descending currents through the external circulating-tubes 11, which, not being exposed to heat, offer no resistance to the downward passage of the columns of water which they contain. The water as displaced by heat is thus successively replaced by colder water, and a thorough and rapid circulation is insured, by which steam is
 20 freely and rapidly generated, and the heat of the escaping products of combustion effectively and economically utilized. The employment of the enlarged fire-box casing and circulating-tubes enables the volume of water-space to be materially reduced relatively to
 25 that of boilers of the ordinary construction, and by the enlargement of the upper portion of the shell increase of steam-space may be effected, as desired.

The rapid steam-generating capacity of the
 35 boiler resultant upon the facilities it affords for free and thorough circulation enables a comparatively large horse-power to be afforded within a relatively small compass, which,

under many conditions of service, is a matter of material importance in adaptation to required duty. 40

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

1. The combination, in a steam-boiler, of a shell, an internal fire-box, a fire-box casing of enlarged diameter relatively to the shell, a series of internal fire-tubes, and a series of external circulating-tubes extending from the upper portion of the water-space of the shell to the enlarged fire-box casing and leading vertically and directly thereinto, substantially as set forth. 50

2. The combination, in a steam-boiler, of a shell, an internal fire-box, a fire-box casing of enlarged diameter relatively to the shell, an annular head connecting the shell and fire-box casing, a series of internal fire-tubes, and a series of external circulating-tubes connected at their upper ends to the shell and passing vertically through the annular head into the water-space of the fire-box, substantially as set forth. 60

3. The combination, in a steam-boiler, of a shell, an internal fire-box, a series of internal fire-tubes, a series of external circulating-tubes opening at their lower ends into the water-space of the fire-box, a series of heads or fittings connected directly to the shell and to the upper ends of the circulating-tubes, and caps closing openings in said heads above the circulating-tubes, substantially as set forth. 70

BENJAMIN BRAZELLE.

Witnesses:

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M. G. REYNOLD.