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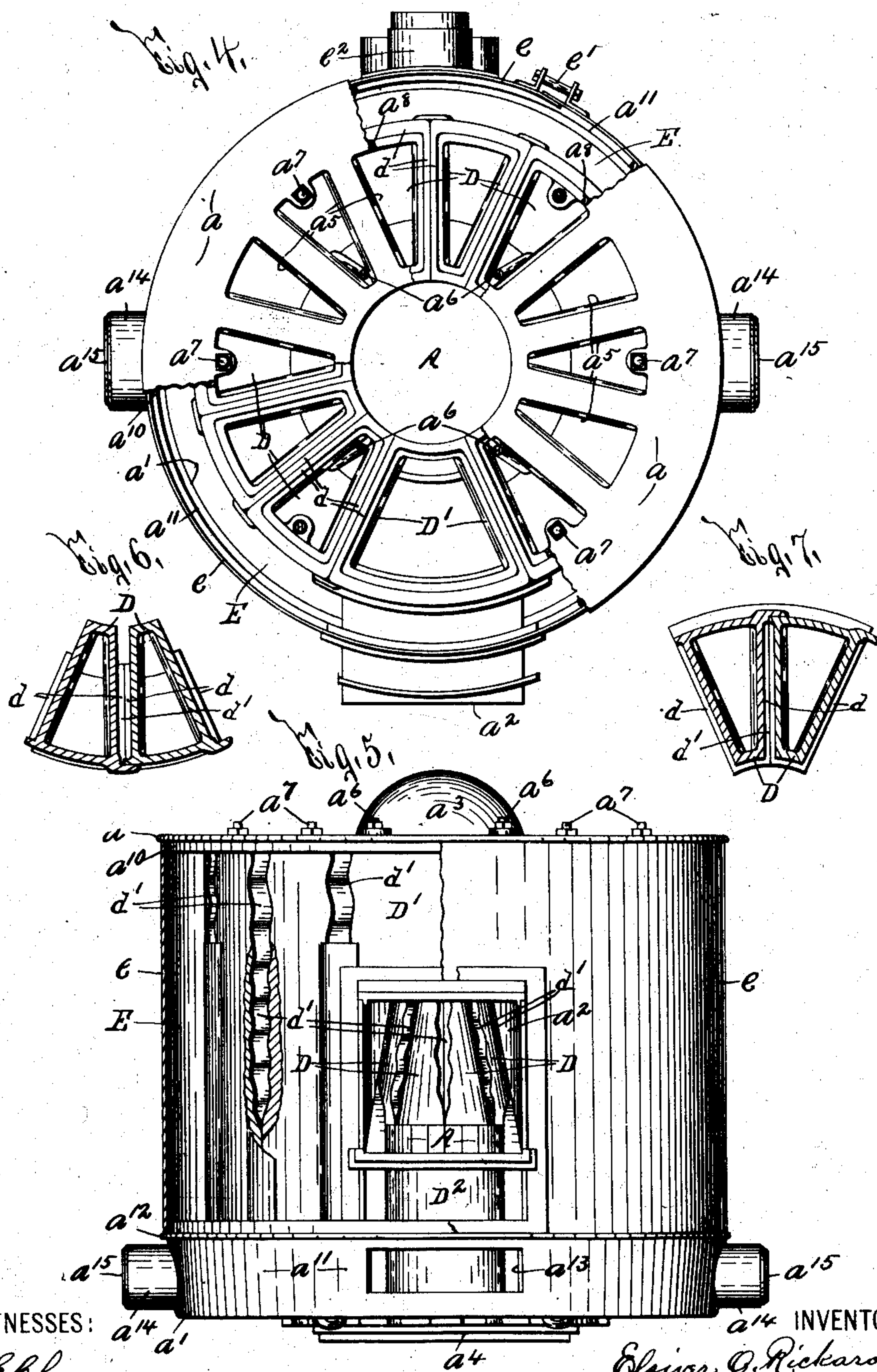
Patented Aug. 5, 1902.

E. O. RICKARD.  
FURNACE.

(Application filed Feb. 6, 1900.)

(No Model.)

5 Sheets—Sheet 3.



WITNESSES:

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INVENTOR

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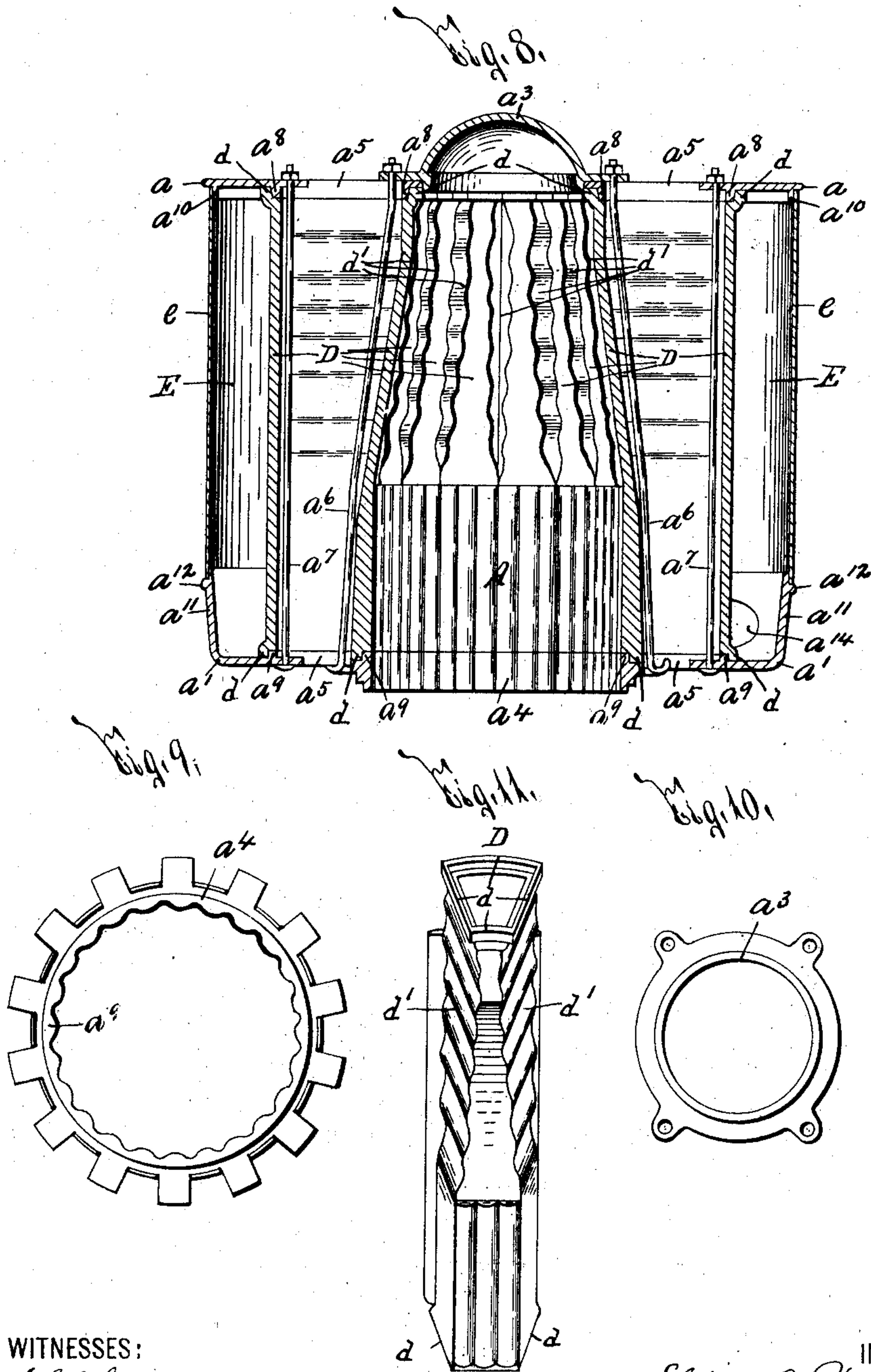
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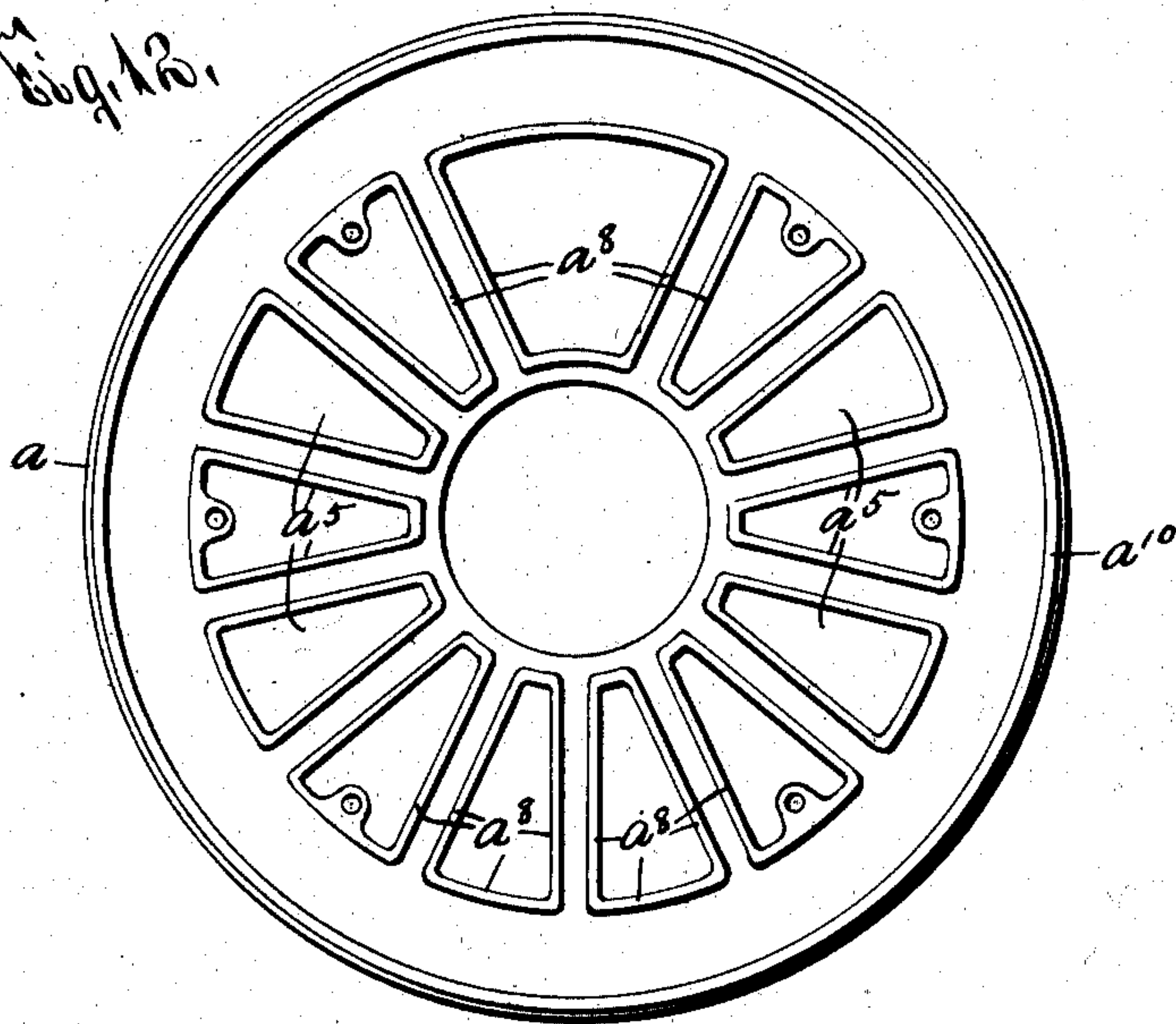
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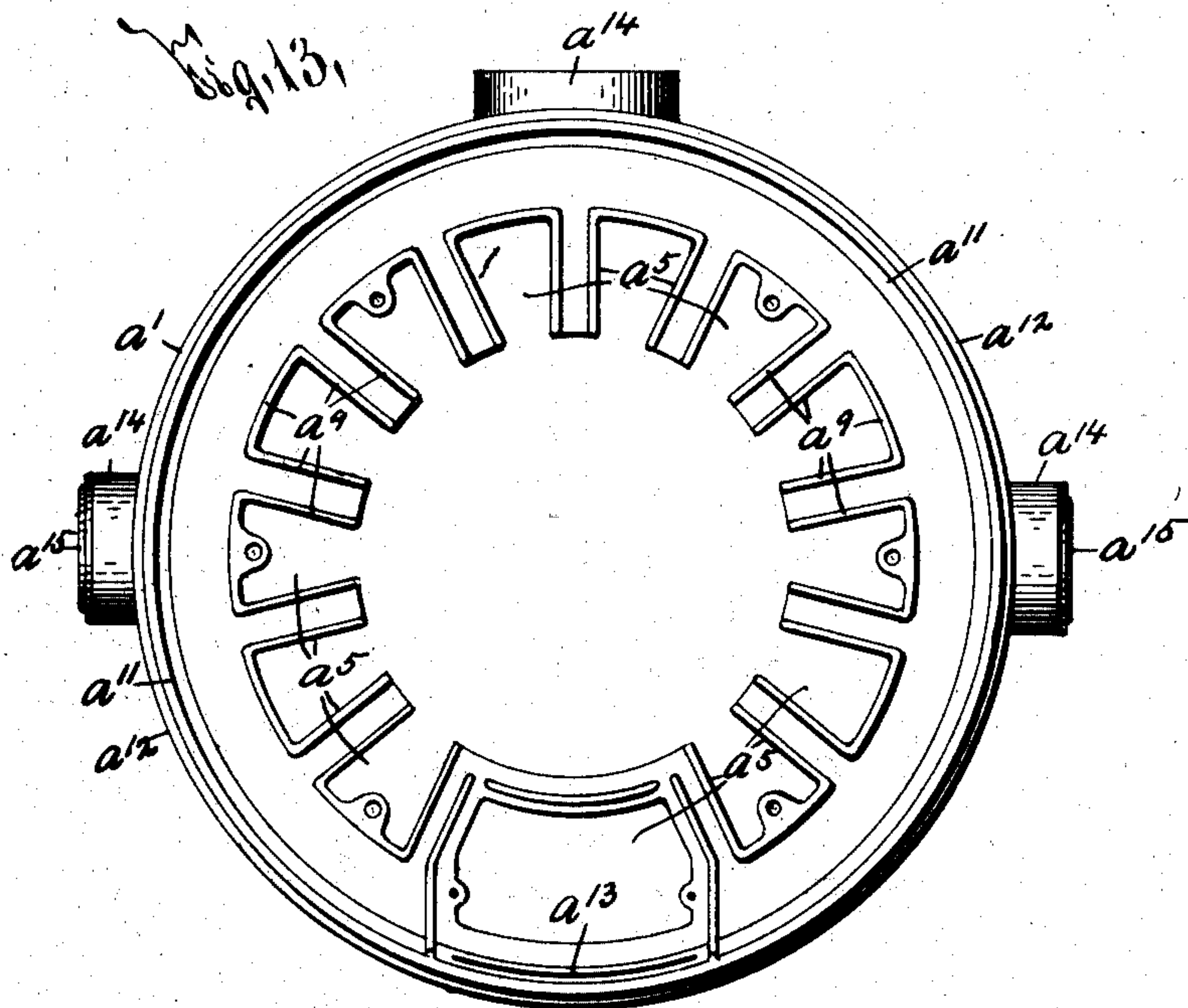
(No Model.)

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*Fig. 13.*



*Fig. 13.*



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# UNITED STATES PATENT OFFICE.

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## FURNACE.

SPECIFICATION forming part of Letters Patent No. 706,496, dated August 5, 1902.

Application filed February 6, 1900. Serial No. 4,164. (No model.)

*To all whom it may concern:*

Be it known that I, ELZIVER O. RICKARD, of Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to improvements in furnaces for heating air, and has for its object the production of a device for the desired purpose which is particularly simple in construction, strong and durable in use, and highly efficient in operation; and to this end it consists in the combination, construction, and arrangement of the component parts of a furnace, as hereinafter fully described, and pointed out in the claims.

In describing this invention reference is had to the accompanying drawings, forming part of this specification, in which like letters indicate corresponding parts in all the views.

Figure 1 is a vertical sectional view, partly broken away, of my improved furnace. Figs. 2 and 3 are respectively top, plan, and rear elevations of the parts illustrated in Fig. 1, the outer shell, the cold-air chamber, and the ash-box being removed. Fig. 4 is a top plan view, partly broken away, of the parts shown in Fig. 3, the detachable central portion of the upper plate seen in said Fig. 3 being removed. Fig. 5 is a front elevation, partly broken away and in section, of the parts illustrated in Fig. 4. Figs. 6 and 7 are transverse sectional views looking in opposite directions, taken on line 6 7, Fig. 1. Fig. 8 is a vertical sectional view taken on line 8 8, Fig. 2. Figs. 9 and 10 are respectively top plan of the detachable central portion of the lower plate seen in Fig. 8 and inverted plan of the detachable central portion of the upper plate shown in said figure. Fig. 11 is an isometric view of one of the detached air-heating conduits of my furnace. Figs. 12 and 13 are respectively inverted views of the outer portion of the upper plate illustrated in Fig. 8 and top plan view of the outer portion of the lower plate shown in said figure.

My improved furnace consists, essentially, of a combustion-chamber A, an ash-box B, a cold-air chamber C, air-heating conduits and chambers D D' D<sup>2</sup>, a chamber E for receiving the products of combustion, and an outer

shell F. The combustion-chamber A is of any desirable form and size, being here illustrated as cylindrical and as inclosed by the air-heating conduits and chambers D D' D<sup>2</sup> and upper and lower separable plates *a a'* and as communicating with a fuel-inlet passage *a*<sup>2</sup>, extending rearwardly from the front of the furnace. Said plates *a a'* project outwardly beyond the combustion-chamber A, are provided with detachable central portions *a*<sup>3</sup> *a*<sup>4</sup> and with openings *a*<sup>5</sup>, extending vertically through their outer portions and alined with each other, and are united together by inner and outer series of bolts *a*<sup>6</sup> *a*<sup>7</sup>, engaged, respectively, with the inner and outer portions of said plates *a a'* and passed through the conduits D, presently described. The opposing faces of the plates *a a'* are formed with substantially vertical projecting shoulders *a*<sup>8</sup> and flanges *a*<sup>10</sup> *a*<sup>11</sup>, the flange *a*<sup>10</sup> of the upper plate *a* being extended downwardly and formed of less diameter than said plate and the flange *a*<sup>11</sup> of the lower plate *a'* being extended upwardly and formed of greater height than the flange *a*<sup>10</sup> and being provided with an outwardly-projecting peripheral shoulder *a*<sup>12</sup>, arranged above the top face of the plate *a'*. Said flange *a*<sup>11</sup> is also provided with an opening *a*<sup>13</sup>, extending horizontally through its front part beneath the shoulder *a*<sup>12</sup> and with outwardly-projecting tubular branches or extensions *h*<sup>14</sup>, arranged beneath said shoulder *a*<sup>12</sup>, one or more of the branches or extensions *a*<sup>14</sup> being provided with a suitable closure *a*<sup>15</sup> for permitting cleaning of the chamber E and another of the branches or extensions being connected to a smoke-conduit G.

The ash-box B is arranged beneath the combustion-chamber A and extends forwardly beyond said chamber A, the top *b* of the forwardly-extending part of the ash-box being separated from the contiguous portion of the plate *a'*, previously described. The cold-air chamber C partly incloses the ash-box B and extends upwardly above the forwardly-projecting part of said ash-box.

The air-heating conduits and chambers D D' D<sup>2</sup> extend vertically around the combustion-chamber A. Said conduits D are arranged at opposite sides of the fuel-inlet passage *a*<sup>2</sup>, are of substantially uniform length,



communicate at their opposite ends with adjacent openings  $a^5$  in the plates  $a$   $a'$ , previously described, and are provided at their ends with shoulders  $d$ , engaged with the shoulders  $a^8$   $a^9$  of the plates  $a$   $a'$ . The opposing walls of the two conduits D, at opposite sides of the passage  $a^2$ , are obviously separated, and the remaining opposing walls of each pair of the conduits D are formed with their lower portions substantially flat and in contact with each other and their upper portions corrugated and separated for forming corrugated heating-surfaces within the conduits D and corrugated passages or flues  $d'$ , leading from the combustion-chamber A between the conduits D to the chamber E. The air-heating chamber D' is formed with an open top communicating with one of the openings  $a^5$  of the upper plate  $a$ . The air-heating chamber D<sup>2</sup> is arranged beneath the fuel-inlet passage  $a^2$ , above the forwardly-projecting part of the ash-box B and between the separated conduits D at opposite sides of said fuel-inlet passage and is formed with its bottom and front sides open for communicating, respectively, with one of the openings  $a^5$  of the plate  $a'$  and the opening  $a^{13}$  of the flange  $a^{11}$ , said openings  $a^5$   $a^{13}$  thus forming, essentially, upper and lower air-circulating openings for the chamber D<sup>2</sup>.

The chamber E is inclosed by the upper and lower plates  $a$   $a'$ , previously described, a tubular shell  $e$ , the outer walls of the conduits and chamber D D', and the inner wall of the chamber D<sup>2</sup>. Said tubular shell  $e$  preferably consists of a split steel shell surrounding the flange  $a^{10}$  of the plate  $a$  and the upper portion of the flange  $a^{11}$  and having its end edges respectively engaged with the lower face of the upper plate  $a$  and the shoulder  $a^{12}$  of the lower plate  $a'$  and its contiguous edges secured together by suitable fastening means  $e'$ . The tubular shell  $e$  is usually provided with a fixed nipple  $e^2$ , which projects through the outer shell  $f$  and is connected to the smoke-conduit G.

The outer shell F is of any desirable form, size, and construction and receives the air heated by my furnace.

The construction and operation of my furnace will now be readily understood upon reference to the foregoing description and the accompanying drawings, and it will be obvious that more or less change may be made in the detail construction and arrangement of its component parts without departing from the spirit of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a furnace, the combination of upper and lower separable plates having openings extending vertically therethrough, a tubular shell interposed between the upper and lower plates, and upright air-heating conduits arranged between the upper and lower plates within the tubular shell and communicating

with the openings in the upper and lower plates, the lower portions of the opposing walls of contiguous conduits being formed substantially flat and engaged with each other and the upper portions of said walls being corrugated and separated, substantially as and for the purpose set forth.

2. In a furnace, the combination of upper and lower separable plates provided with openings extending vertically therethrough and having their opposing faces formed with substantially vertical flanges, the flange of the upper plate being of less diameter than said upper wall, and the flange of the lower plate being provided with a peripheral shoulder arranged above the top face of the lower plate, a tubular shell surrounding the flange of the upper plate and the upper portion of the flange of the lower plate, and having its end edges respectively engaged with the lower face of the upper plate and the peripheral shoulder of the flange of the lower plate, upright air-heating conduits arranged between the upper and lower plates within the tubular shell and communicating with the openings in the upper and lower plates, the lower portions of the opposing walls of contiguous conduits being formed substantially flat and engaged with each other and the upper portions of said walls being corrugated and separated, and bolts passed through the air-heating conduits and engaged with the upper and lower plates, substantially as and for the purpose specified.

3. In a furnace, the combination of upper and lower separable plates having openings extending vertically therethrough, the upper plate being provided with a detachable central portion encircled by the openings therein, and the lower plate being provided with an upwardly-extending flange having outwardly-projecting tubular branches or extensions, a tubular shell interposed between the upper plate and the upwardly-extending flange of the lower plate above the tubular branches or extensions, upright air-heating conduits arranged between the upper and lower plates and communicating with the openings in said plates, and bolts passed through the air-heating conduits and engaged with the detachable central portion of the upper plate and with the lower plate, substantially as and for the purpose set forth.

4. In a furnace, the combination of upper and lower separable plates having openings extending vertically therethrough and being each provided with a detachable central portion encircled by the openings therein, the lower plate being also provided with an upwardly-extending flange having outwardly-projecting tubular branches or extensions, a tubular shell interposed between the upper plate and the upwardly-extending flange of the lower plate above the tubular branches or extensions, upright air-heating conduits arranged between the upper and lower plates and communicating with the openings in said



plates, an outer series of bolts passed through the air-heating conduits and engaged with the outer portions of the upper and lower plates, and an inner series of bolts passed  
5 through the air-heating conduits and engaged with the detachable central portions of the upper and lower plates, substantially as and for the purpose described.

5. In a furnace, the combination of upper  
10 and lower separable plates having openings extending vertically therethrough, a tubular shell interposed between the upper and lower plates, upright air-heating conduits arranged  
15 between the upper and lower plates within the tubular shell and communicating with the openings in the upper and lower plates, the opposing walls of two of the conduits being  
20 separated and the remaining opposing walls of each pair of the conduits having their lower portions engaged with each other and their  
25 upper portions corrugated and separated, and an air-heating chamber arranged between the opposing separated walls of said two of the conduits and formed with upper and lower  
openings for the air, substantially as and for the purpose set forth.

6. In a furnace, the combination of upper  
and lower separable plates having openings  
30 extending vertically therethrough, the lower plate being provided with an upwardly-extending flange formed with an opening ex-

tending horizontally therethrough, a tubular  
shell interposed between the upper plate and  
the upwardly-extending flange of the lower  
plate, upright air-heating conduits arranged  
35 between the upper and lower plates within the tubular shell and communicating with corresponding openings in said plates, the  
opposing walls of two of the conduits being  
separated, and the remaining opposing walls  
40 of each pair of the conduits having their lower portions engaged with each other and their  
upper portions corrugated and separated, and an air-heating chamber arranged between the  
opposing separated walls of said two of the  
45 conduits and formed with upper and lower openings communicating with one of the  
openings extending vertically through the lower plate and the opening extending hori-  
zontally through the upwardly-extending  
50 flange of said lower plate, substantially as and for the purpose described.

In testimony whereof I have hereunto  
signed my name, in the presence of two at-  
testing witnesses, at Syracuse, in the county  
55 of Onondaga, in the State of New York, this  
27th day of December, 1899.

ELZIVER O. RICKARD.

Witnesses:

K. H. THEOBALD,  
S. DAVIS.