

J. Gray.

Base-Burning Hot-Air Furnace.

N<sup>o</sup> 73091

Patented Jan. 7, 1868.

Fig. 1.

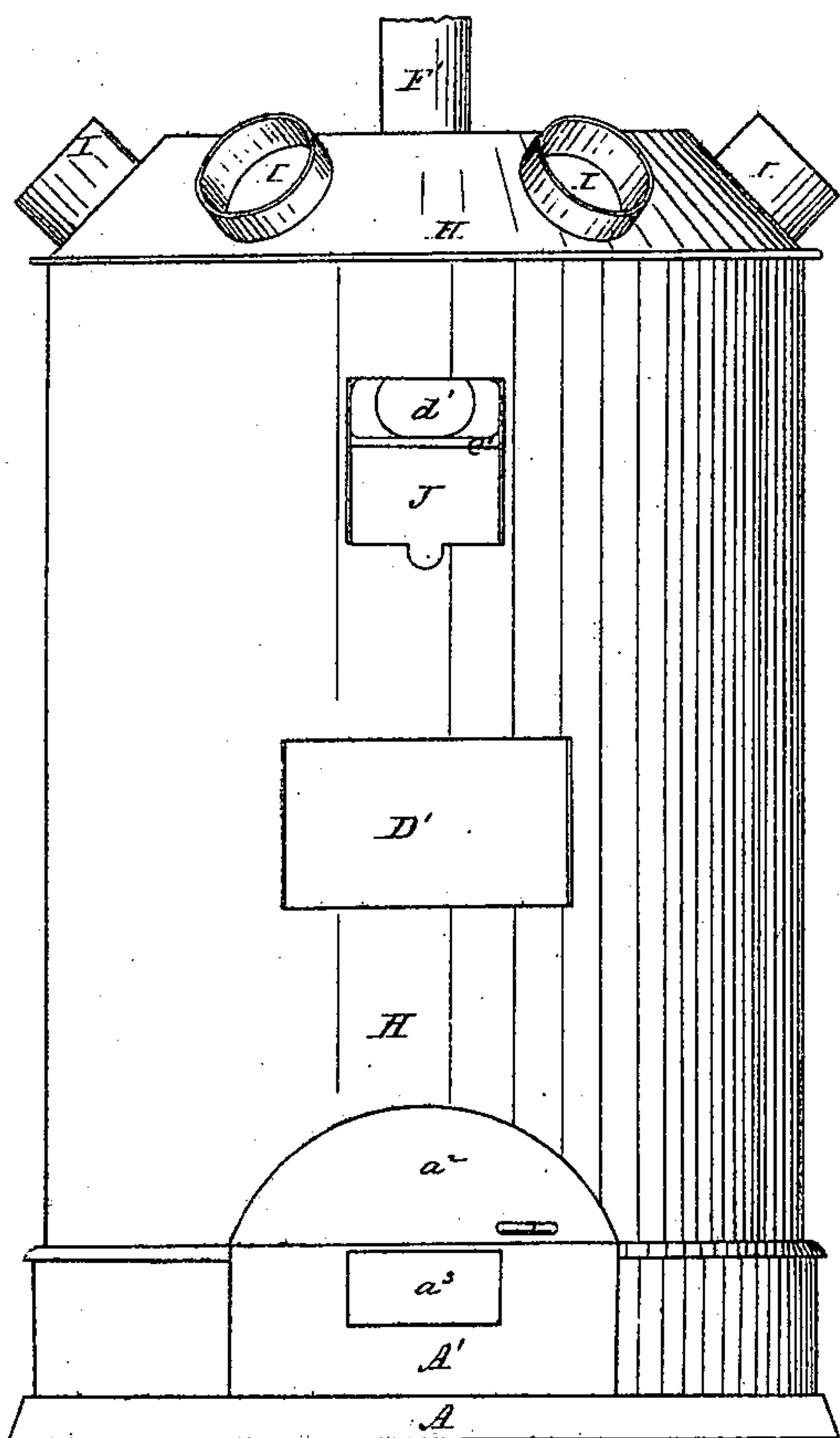


Fig. 2.

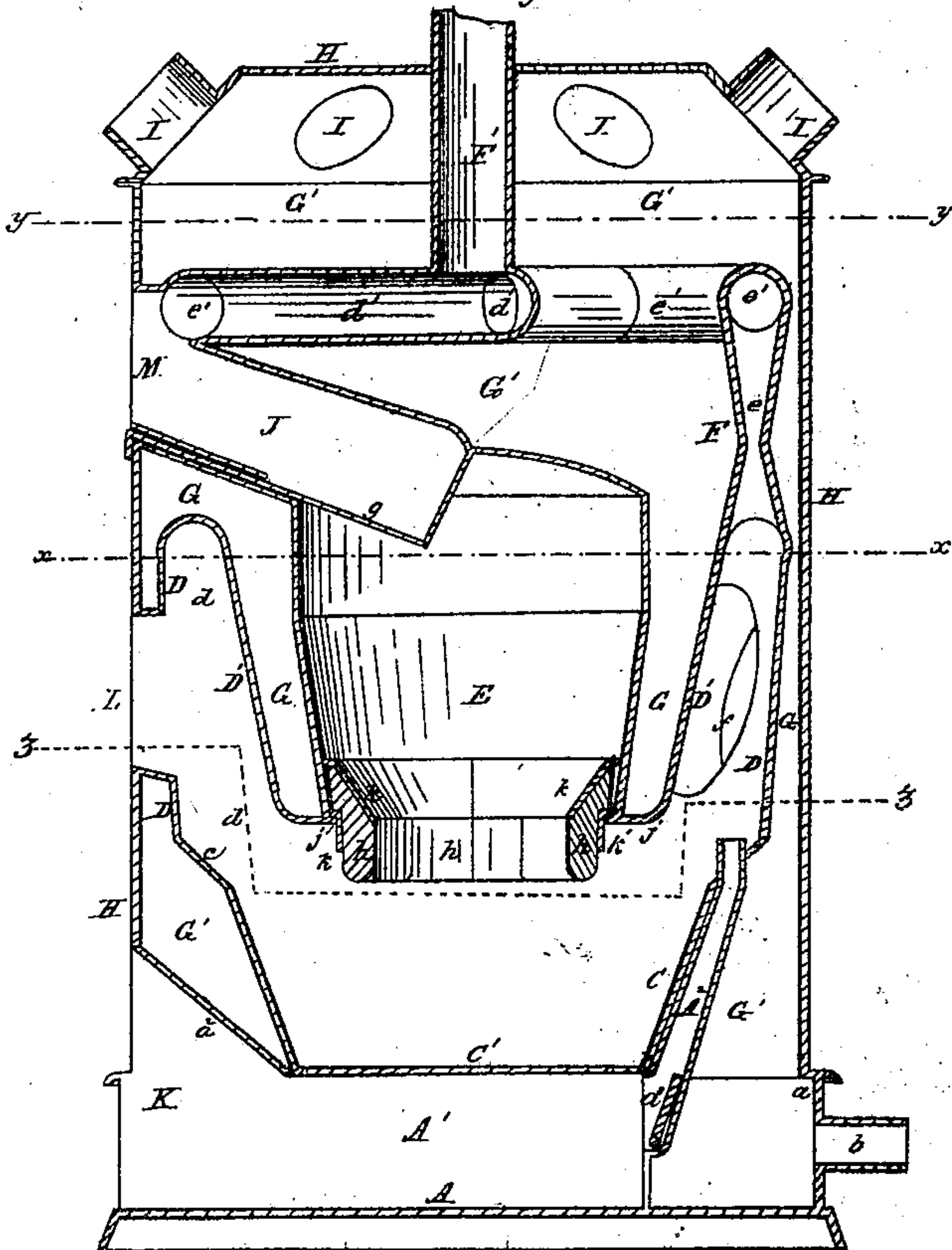


Fig. 3.

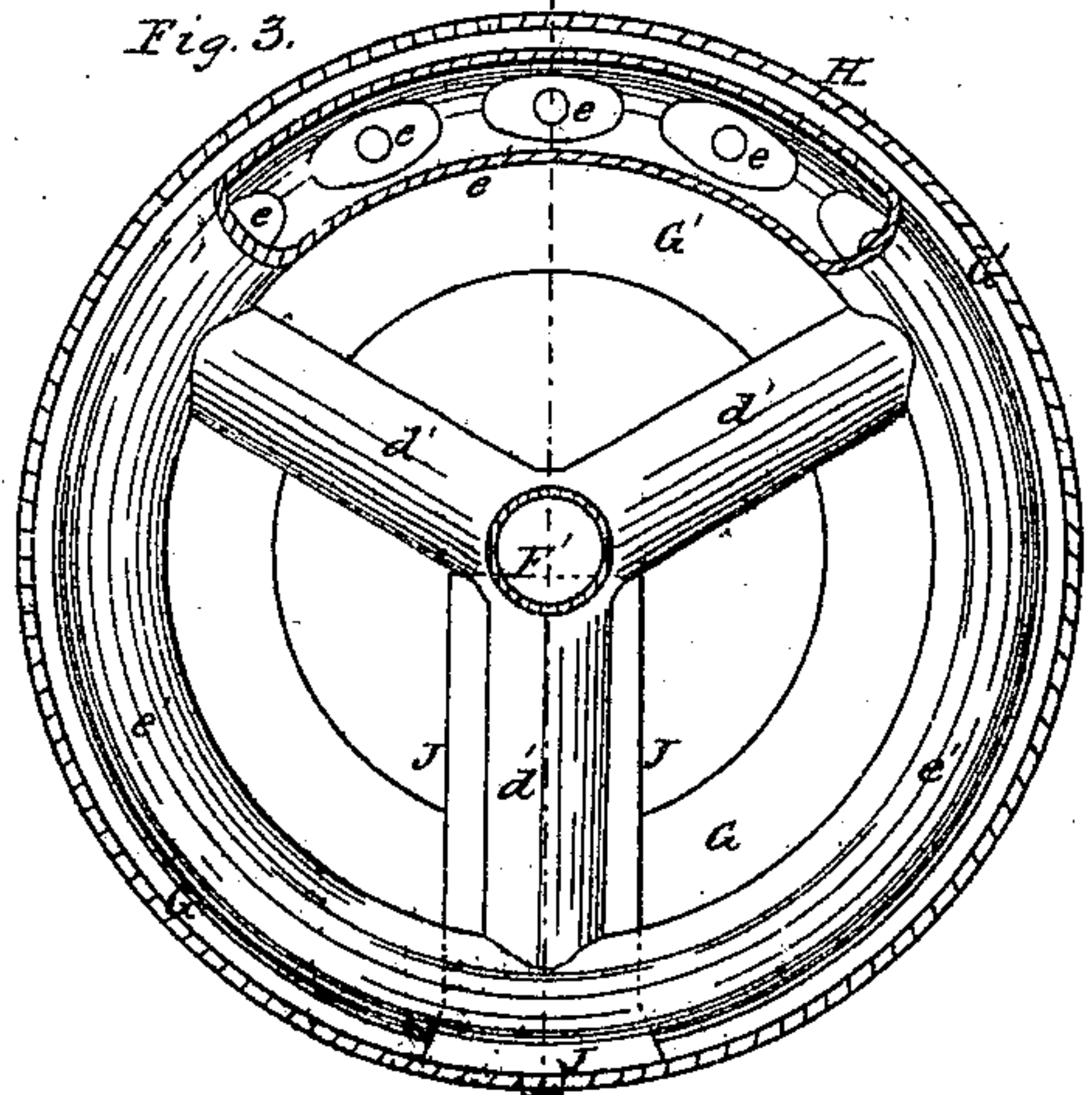
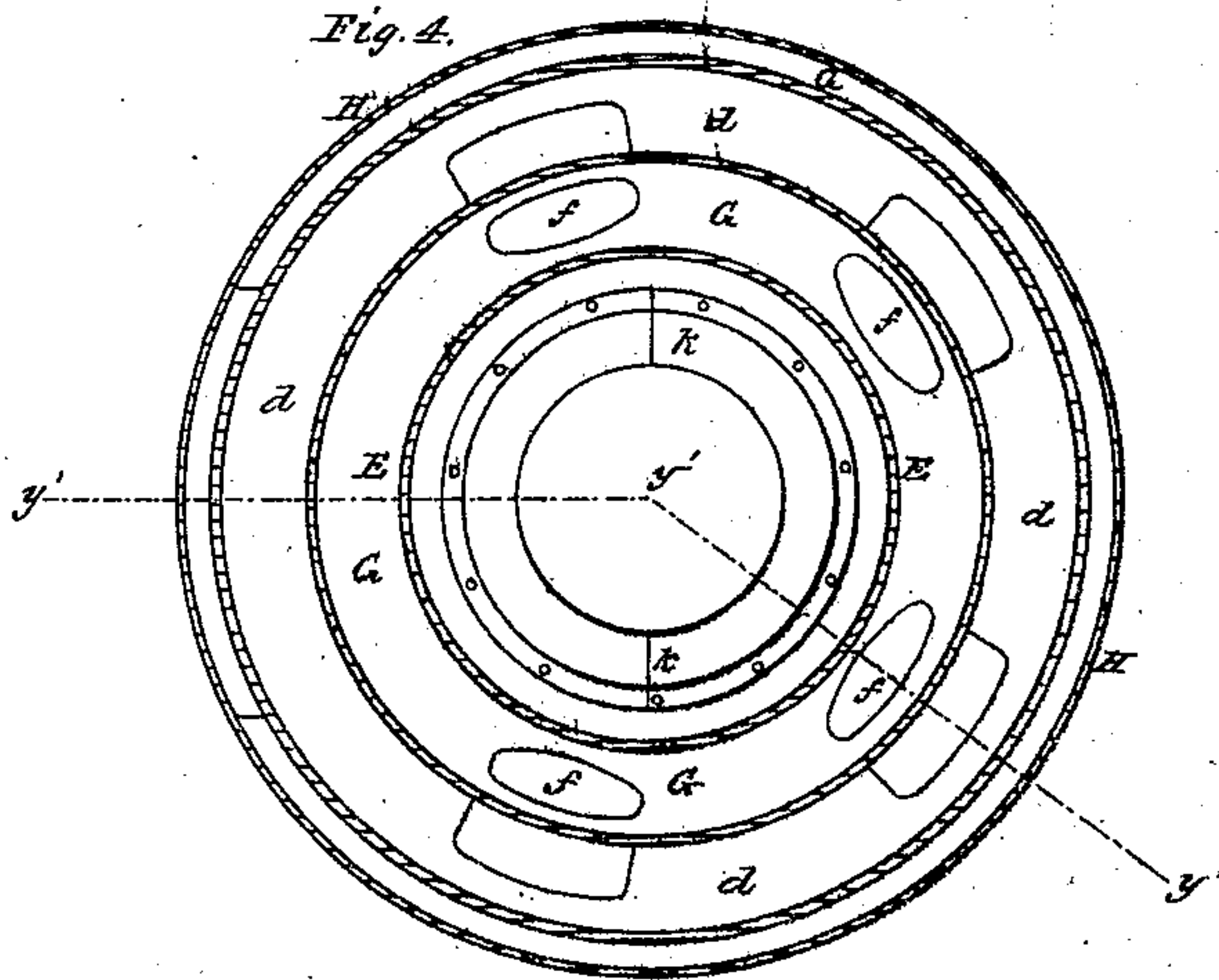


Fig. 4.



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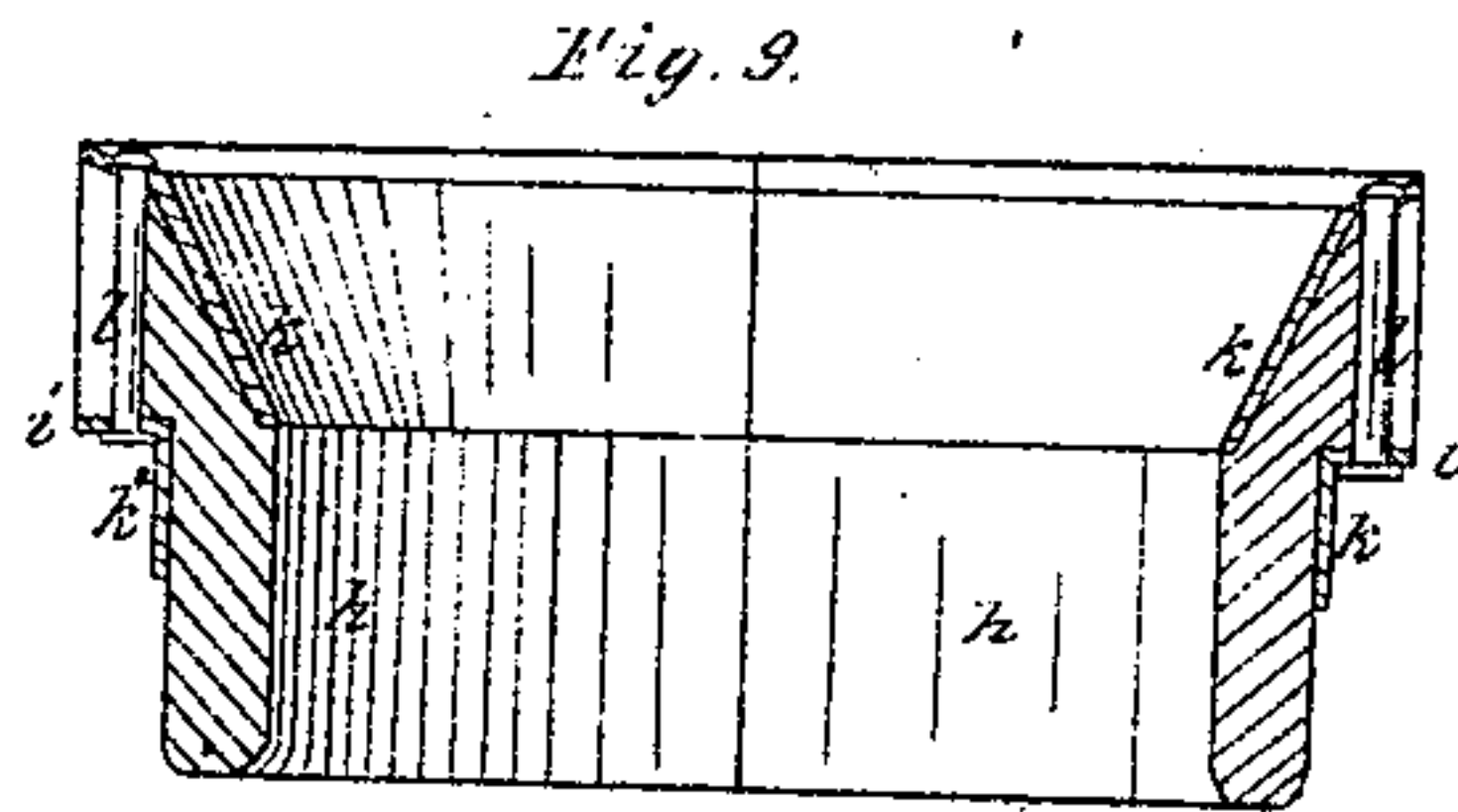
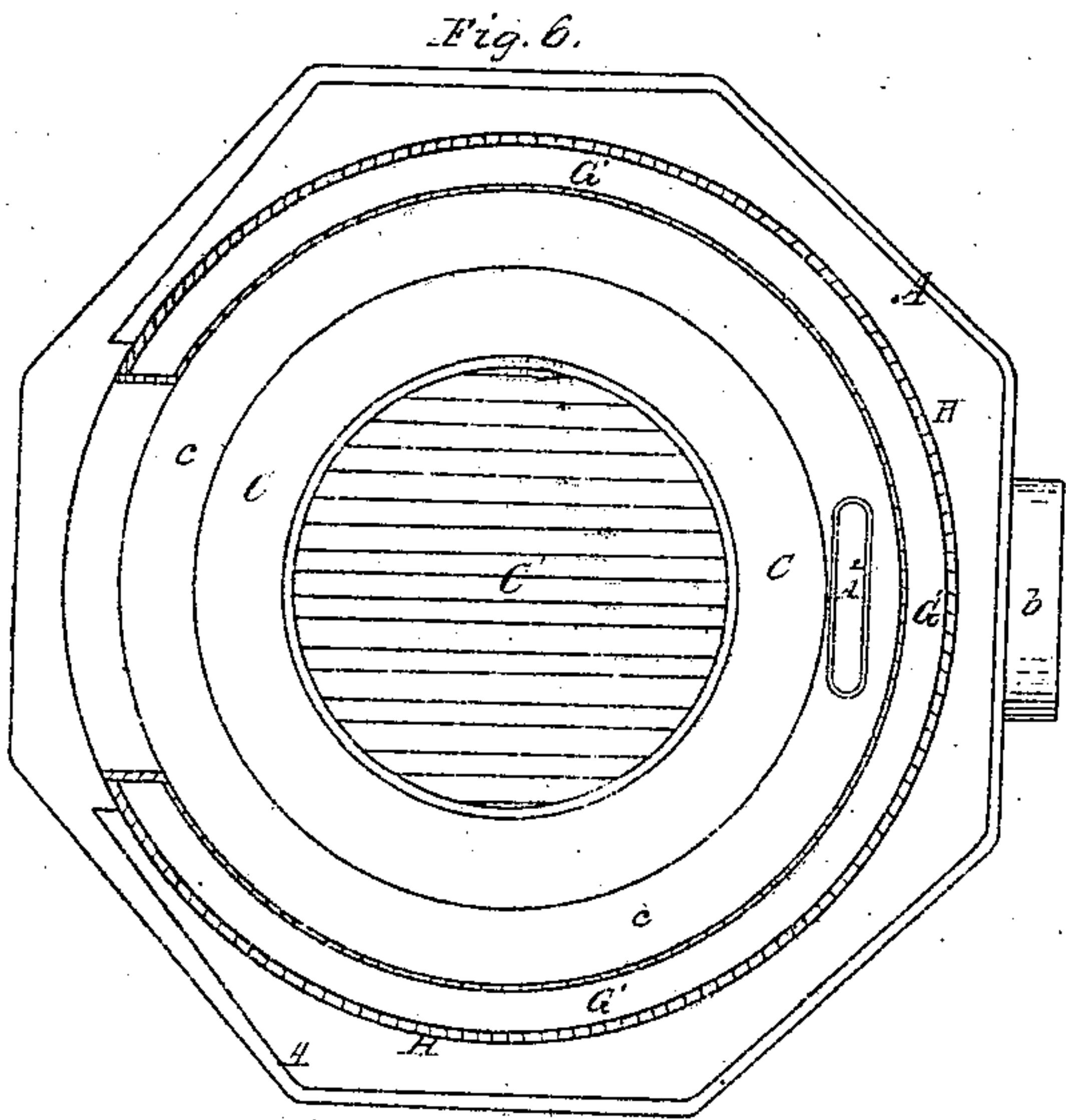
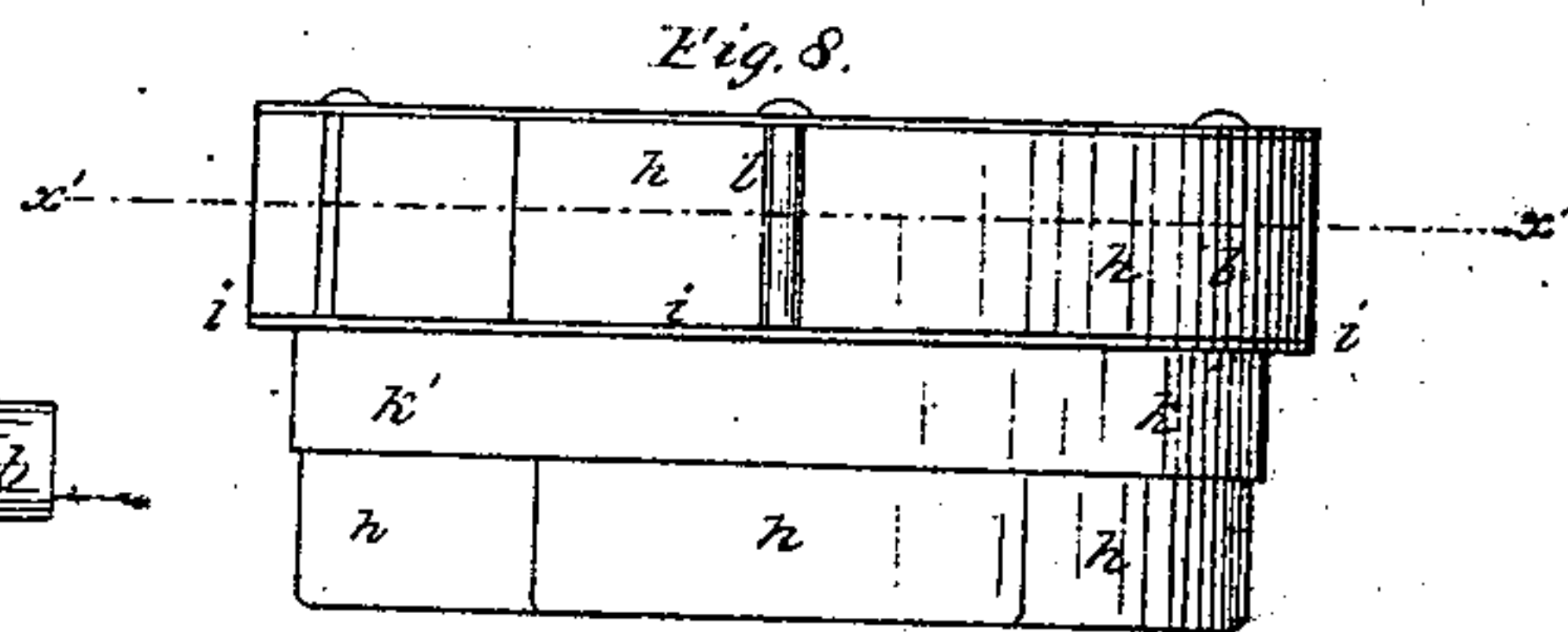
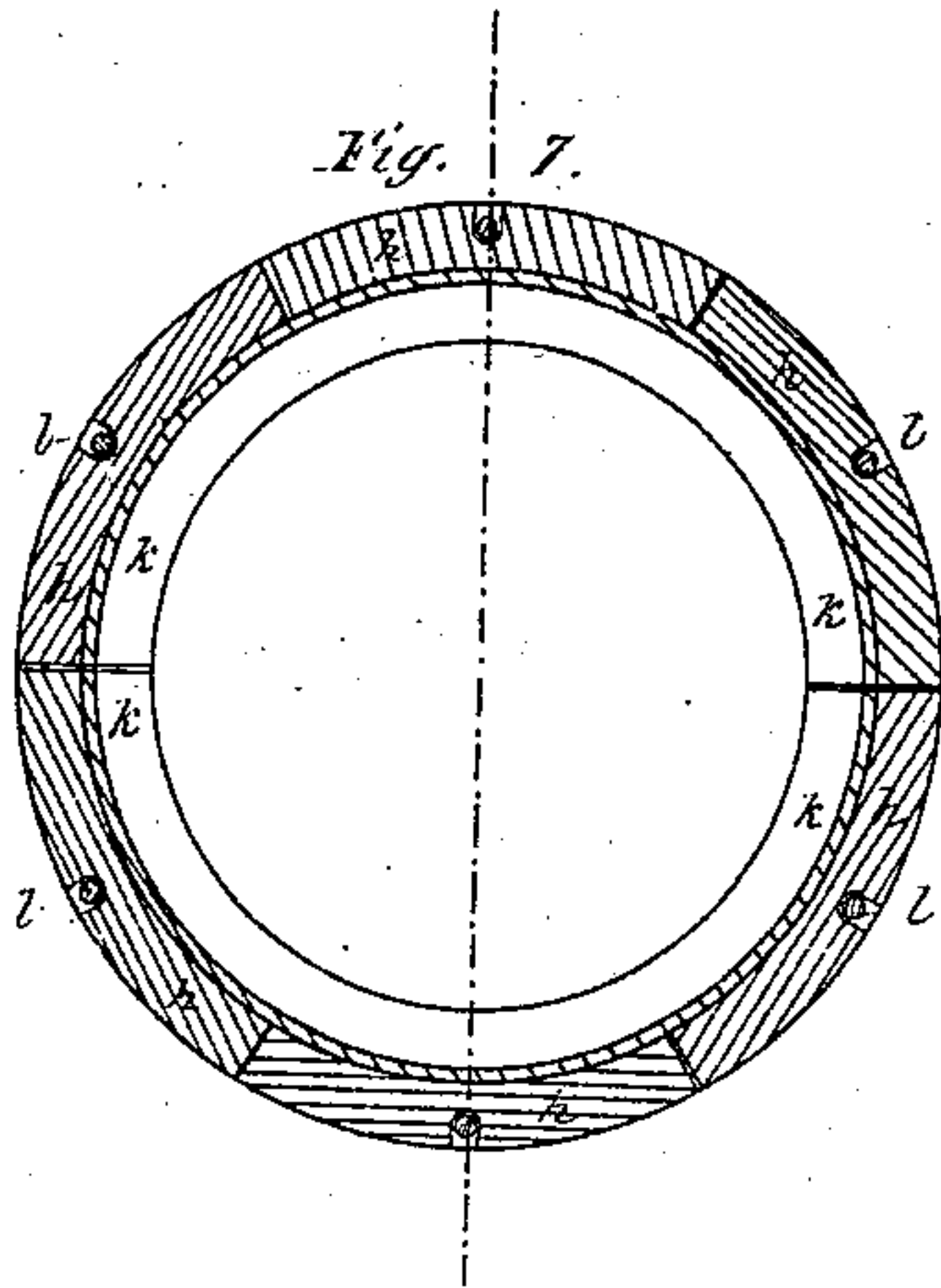
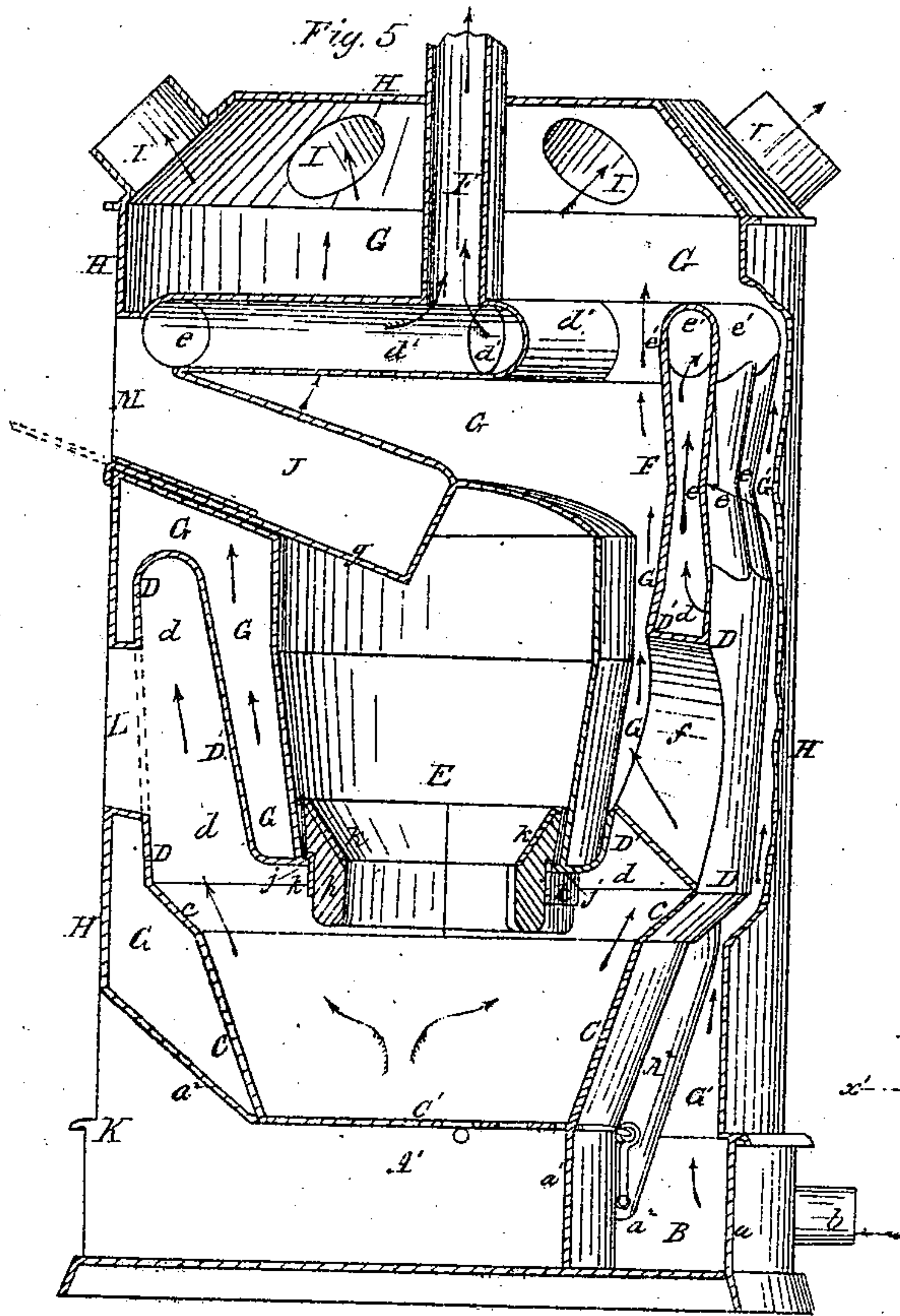
Inventor  
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### Base-Burning Hot-Air Furnace.

Nº 73091

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# United States Patent Office.

JAMES GRAY, OF ALBANY, NEW YORK.

*Letters Patent No. 73,091, dated January 7, 1868.*

## BASE-BURNING HOT-AIR FURNACE.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, JAMES GRAY, of the city of Albany, in the county of Albany, and State of New York, have invented a new and improved Base-Burning, Parlor, Portable, and Stationary Hot-Air Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making a part of this specification, in which—

Figure 1, sheet 1, is a front elevation of the furnace.

Figure 2 is a section taken from front to rear, and in a vertical plane through the centre of the furnace.

Figure 3 is a section through the furnace, taken in the horizontal plane indicated by red line *y y*, fig. 2.

Figure 4 is a section taken in the horizontal plane *x x*, fig. 2.

Figure 5, sheet 2, is a section through the furnace, taken in a vertical plane indicated by the course of red line *y' y'* in fig. 4.

Figure 6 is a section taken in the course indicated by red line *z z* in fig. 2.

Figures 7, 8, and 9 are views of the fire-brick section which is used at the base of the supply-cylinder.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates in part to certain novel improvements on the base-burning stove, for which Letters Patent were granted to me on the 18th day of October, 1864, which improvements are chiefly designed for improving the operation and usefulness of such stove as a parlor-heater, and also to adapt it for a hot-air furnace, for warming other apartments than that in which it is placed.

The object of the first part of my invention is to remedy a serious objection which is found to exist in base-burning furnaces or stoves, in which the coal is fed to a fire-pot or chamber from a coal-supply cylinder or reservoir, in consequence of the accumulation of gas in such reservoir, which commingles with air when the reservoir is opened, and forms an explosive compound. This I avoid by forming a communication between the upper part of the reservoir and an exit-pipe, which will allow of the escape of all gas, and consequently prevent liability of explosion when the supply passage leading into the reservoir is opened for introducing coal, and for other purposes, as will be hereinafter described.

Another objection in base-burning stoves is the admission of cold air, to be warmed, through the lowermost chambers or bases of such stoves, which keeps the lower parts thereof comparatively cool, and affords little or no radiated heat therefrom. This objection is removed by taking in the cold air to be warmed at a point or points above the top of the fire-pot, so that the heat which is radiated from the latter will warm the lower part of the stove, as will be hereinafter described.

Another object of my invention is to obtain a more uniform distribution of heat throughout the upper portion of the stove, and to greatly increase the superficial area of heat-radiating surfaces; at the same time to provide for readily cleaning the passages for the products of combustion, and keeping these passages free from ashes and dust, as will be hereinafter described.

Another object of my invention is to provide a draught-passage for the ash-pit, which is regulated by a damper or valve, for preventing the escape of light ashes and dust into the room during the shaking of the grate, and also for affording means for regulating the draught of the stove, as will be hereinafter described.

Another object of my invention is to provide the lower termination of the coal-reservoir with a protection of removable iron, or of fire-brick, or other refractory substance, which extends below the lower end of this reservoir, and forms a contracted extension thereof below an annular air-heating chamber, as will be hereinafter described.

Another object of my invention is to provide, in a base-burning stove or furnace, for a free circulation of air through passages which are made through and across the annular smoke-chamber *d*, into the annular space *G*, formed between the reservoir and the inner wall *D*, which surrounds a space in which the coal-reservoir is arranged, and which is also extended above said reservoir, for the purpose of augmenting the amount of heating-surface, as will be hereinafter described.

Another object of my invention is to combine with a coal-supply reservoir, and an annular hollow open-work chamber, through which the products of combustion pass, an annular casing, in such manner that cool air, admitted into such casing, will be caused to circulate through the openings which are through said chamber, and become heated before passing out of the casing, as will be hereinafter described.



Another object of my invention is to employ, in a base-burning hot-air furnace, a chute or passage, leading through one side of the external casing, and into the upper part of the coal-reservoir, so that coal can be conveniently supplied to said reservoir through the side, instead of through the top of the furnace, as will be hereinafter described.

To enable others skilled in the art to understand my invention, I will describe its construction and operation.

In the accompanying drawings, A represents the base-plate of the furnace, upon which outer and inner walls  $a$   $a'$  are secured, forming the ash-pit,  $A^1$ , and also an outer chamber, B, into which the passage  $b$  conducts cool air. On top of the ash-pit section is the outwardly-flaring fire-pot, C, the bottom of which is a grate,  $C'$ , that may be constructed in the well-known manner, with the exception that its shank or shaking-bar can be made very short, in consequence of the large flaring mouth of the ash-pit, which is formed by the inclined and arched plate  $a^2$ , shown in figs. 1, 2, and 5. The inner and lowest edge of the arched plate  $a^2$  extends nearly to the outer edge of the grate, so that a very short shank can be conveniently used for shaking or tilting the grate. The entrance to the ash-pit K will be provided with a door, applied to the outer casing surrounding the furnace. At the back of the ash-pit  $A^1$  is an opening, which communicates with an ascending flue,  $A^2$ , that is provided with a damper,  $a^3$ , and that leads into the combustion-chamber above the upper edge of the fire-pot, C, as shown in figs. 2 and 6. When the damper  $a^3$  is opened, there will be an upward draught through the flue  $A^2$ , which will carry off light dust from the ash-pit during the operation of shaking the grate. This flue will also admit cool air into the combustion-chamber when the damper  $a^3$  is opened.

The upper edge of the fire-pot C has an outwardly-flaring rim,  $c$ , formed on it, to the outer edge of which an annular wall, D, is secured, which forms, in conjunction with an inner wall,  $D'$ , a smoke-chamber, having its lower end opening into the fire-space above the fire-pot C, and surrounding the air-chamber G, and thence through the vertical contracted passages  $e$   $e$ , opening at their upper ends into a hollow ring,  $e'$ , thence through the horizontal pipes  $d'$   $d'$   $d'$  to the exit-pipe  $F'$ , shown in figs. 2, 3, and 5.

The lower end of the inner wall  $D'$  is curved or contracted, and secured to the lower end of the coal-reservoir E, so as to form an annular space, G, between the reservoir and said wall  $D'$ , as clearly shown in figs. 2, 4, and 5. The upper end of this chamber or space G communicates with the air-space  $G'$ , which is formed by the external casing H, which encloses the entire heating-arrangement.

The open-work section F, which caps the annular smoke-chamber  $d$ , is composed of a number of vertical contracted passages,  $e$   $e$ , opening at their upper ends into a hollow ring,  $e'$ , above the highest point of the coal-reservoir, as shown in the drawings. The smoke or products of combustion is conducted off to the main or central exit-flue,  $F'$ , by means of the radial pipes  $d'$ . This mode of constructing the open-work section F affords a very large amount of air-heating surface, and also concentrates the heat, by retarding the draught or escape of the heated products of combustion. It will be seen that the main flue  $F'$  is arranged over the centre of the coal-reservoir E, and that communications are made with this flue by radial pipes, which are also arranged over the coal-reservoir, and form heating-chambers for the surrounding air. This arrangement of the flue  $F'$  will cause the heated products of combustion rising from the fire-pot to ascend equally on all sides of the annular chamber  $d$ , and through all of the contracted passages  $e$   $e$ , so that every part of the furnace will be uniformly heated. Below the open-work section F, and above the upper edge of the fire-pot C, circular or elliptical or other-shaped air-passages,  $f$   $f$ , are made through the two walls  $D$   $D'$ , and space  $d$ , for the purpose of allowing of a circulation of air between the space G and space  $G'$ . These passages  $f$  allow air from the chamber  $G'$  to enter the space G below the section F, and to become heated by impingement upon the inner wall  $D'$ .

The external casing H, which encloses the entire heating-arrangement above described, is provided at its upper end with one or more hot-air escape-flues, I, from which the heated air is conducted into upper apartments, or wherever desired, and it is also provided with door-openings, K, L, and M, leading into the ash-pit section, into the combustion-chamber or fire-pot, and also into the coal-reservoir. The latter opening communicates with the coal-reservoir E through an inclined passage or chute, J, which is provided with a damper,  $g$ , by which the communication can be cut off at pleasure. This passage J also communicates with the flue  $F'$ , through the hollow ring  $e'$  and horizontal pipe or pipes  $d'$ , as shown in figs. 1, 2, and 5, so that when the damper  $g$  is open, the gas from the coal-reservoir will be carried off into the main flue. The passage leading into the chute J should be provided with an outer door; so, also, should the passage through casing H, which leads into the combustion-chamber be provided with a door or window. The cool air may be admitted into the casing H through the opening  $b$ , leading into the space surrounding the ash-pit, as shown in figs. 2 and 5. This casing may be made of metal, or it may consist of brick-work built up around the heating-apparatus.

I protect the lower ends of the coal-reservoir E, and wall  $D'$ , where these parts are united to form the smoke-passage  $d$  and air-space G, by means of iron, or of fire-brick, soapstone, black lead, or other suitable refractory substance, which is made up in the form of a cylinder, in sections  $h$   $h$ , which sections have shoulders,  $i$ , formed on their external surfaces, by which they are supported in place upon the annular lip  $j$ . These sections  $h$  are made of the required shape, and secured together by means of two metal plates,  $k$   $k'$ , and vertical bolts  $l$   $l$ , as shown in figs. 7, 8, and 9. The top plate or flaring ring,  $k$ , protects the upper part of the lining  $h$  from injury by the descending coal in reservoir E, and the lower shouldered ring  $k'$  sustains the lining  $h$  upon the lip  $j$ . When these segments are made wholly of iron they can be cast in the required shape, and fitted in their place without the use of the metal plates and vertical bolts, as described. Two or more of the segments or sections  $h$  make the cylinder complete, and in this form they may be put in place from the bottom of the reservoir, and made to form a firm and substantial fixture. They may be readily removed for repairing, without taking the furnace asunder.

Having described the mode of constructing the stove or furnace, I will now briefly describe the operation of the same.



The fire is started upon the grate, through the front door leading into the combustion-chamber, after which the fuel is supplied through the coal-reservoir. Before coal is put into this reservoir, it is necessary to draw out the damper  $g$ , and allow the gases to escape into flue  $F'$ , after which the door leading into the passage or chute  $J$  can be safely opened. It will be seen that the damper  $g$  can be opened or closed when the front door leading into the chute is closed.

When it is desired to shake the grate, the damper  $a^3$  is opened, so that the light dust and ashes will be drawn up through the pipe  $A^2$ , instead of escaping into the room from the ash-pit door. This damper  $a^3$  is also a perfect regulator to the draught of the furnace, diminishing it while open, and increasing it while closed.

The fire-brick lining  $h$ , being made in sections, each section being secured firmly between ring-segments, as described, is protected, itself, from injury, and serves to protect the lower ends of the reservoir-cylinder and wall  $D'$  from the intense heat of the fire. By making this lining of segments, separately secured between metal plates, these segments can be applied to or removed from the bottom of the reservoir at pleasure, without disturbing other parts of the stove or furnace. When these segments are made wholly of iron, they also serve to protect the lower end of the reservoir-cylinder and wall  $D'$  from the intense heat of the fire. They can also be applied to or removed from the bottom of the reservoir at pleasure, without disturbing other parts of the stove or furnace.

By my invention, I not only heat the air which is allowed to circulate through the heating-flues or chambers, below the top of the coal-reservoir, but I also provide for heating air above this reservoir by heating-chambers, which are arranged above it. And while this is the case, I also provide for causing the heated products of combustion to rise on all sides of the furnace, and then pass horizontally over the coal-reservoir to a central outlet, thereby securing an equable distribution of heat through the stove, above the combustion-chamber, and outside of the coal-reservoir.

I do not claim in a base-burning furnace any combination with a sinuated body, nor do I claim any combination with the annular flue-ring  $e'$  and short connecting-pipes  $e$ , nor do I claim the combination of the annular flue-ring  $e'$ , the short connecting-pipes  $e$ , and the sliding damper  $g$ .

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

1. In a base-burning stove or furnace, which has a supply-cylinder, I claim an escape-passage from the chute  $J$  through the horizontal pipe  $d'$ , or the hollow ring  $e'$ , into the flue  $F'$ , substantially as described.

2. Providing the chute  $J$ , leading through one side of the external casing into the cylinder  $E$ , with a damper or valve,  $g$ , substantially as described.

3. The construction of the double wall cylinder  $D D'$ , annular chamber  $d d$ , and air-passages  $f f$ , substantially in the manner shown and described.

4. The combination of the magazine  $E$ , outer casing  $H$ , with the hollow open-work section  $F$ , and the annular chamber  $d d$ , with air-passages  $f f$ , crossing it, of a base-burning air-heating furnace, substantially as described.

5. The combination of the magazine  $E$ , central exit-flue  $F'$ , and ascending annular flue  $d$ , leading from the fire-chamber, substantially as and for the purpose described.

6. Conducting the heated products of combustion, rising from the fire-pot  $C$ , around and over the coal-supply cylinder, (and discharging them into a central flue, directly over the centre of the said supply-cylinder,) in combination with warm-air chamber  $G$  and  $G'$ , such chamber being enclosed by wall  $H$ , all for the purpose of heating air which is to be used for warming apartments, substantially as described.

7. Making the iron protector or the guard-plates  $k k$  of the fire-bricks (or their equivalents) portable in segments, so that they may be removed through the lower end of the magazine  $E$ , substantially as described.

8. I claim, in the construction of a base-burning air-heating furnace, having a magazine,  $E$ , an annular circulating-air chamber, and an annular smoke-passage, both surrounding said magazine; and situated between the same and the annular wall  $D$ , the inclined chute or passage  $J$ , provided with a valve,  $g$ , and gas-escape conduit, and adapted to serve as a means for introducing coal into the magazine from a point which is below the top of the outer casing, substantially as described.

9. The flaring arched opening of the ash-pit  $A'$ , formed by the inclined plate  $a^2$ , substantially as described.

10. The combination of the sectional lining  $h h$  with annular circulating space  $G$  and jacket or wall  $D'$ , substantially in the manner described and shown.

11. The combination of the magazine  $E$ , damper or valve  $g$ , the horizontal pipe or pipes  $d'$ , and the hollow ring  $e'$ , substantially as described.

12. The arrangement of flues  $d'$  and  $e'$  so that they can be cleaned by using a flexible-handled brush from inside of the door leading into the coal-supply cylinder or reservoir, substantially as described.

13. In a base-burning air-heating furnace, having a magazine,  $E$ , I claim a doorway or passage, provided with a door or window, and opening into the combustion-chamber through the outer casing of the furnace, substantially as described.

14. In a base-burning air-heating furnace, having a magazine,  $E$ , I claim a passage, covered by a door or window, and leading into the combustion-chamber, through and across the air-chamber formed by the exterior case or wall and the outer wall of the furnace, substantially in the manner and for the purposes described.

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Witnesses:

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