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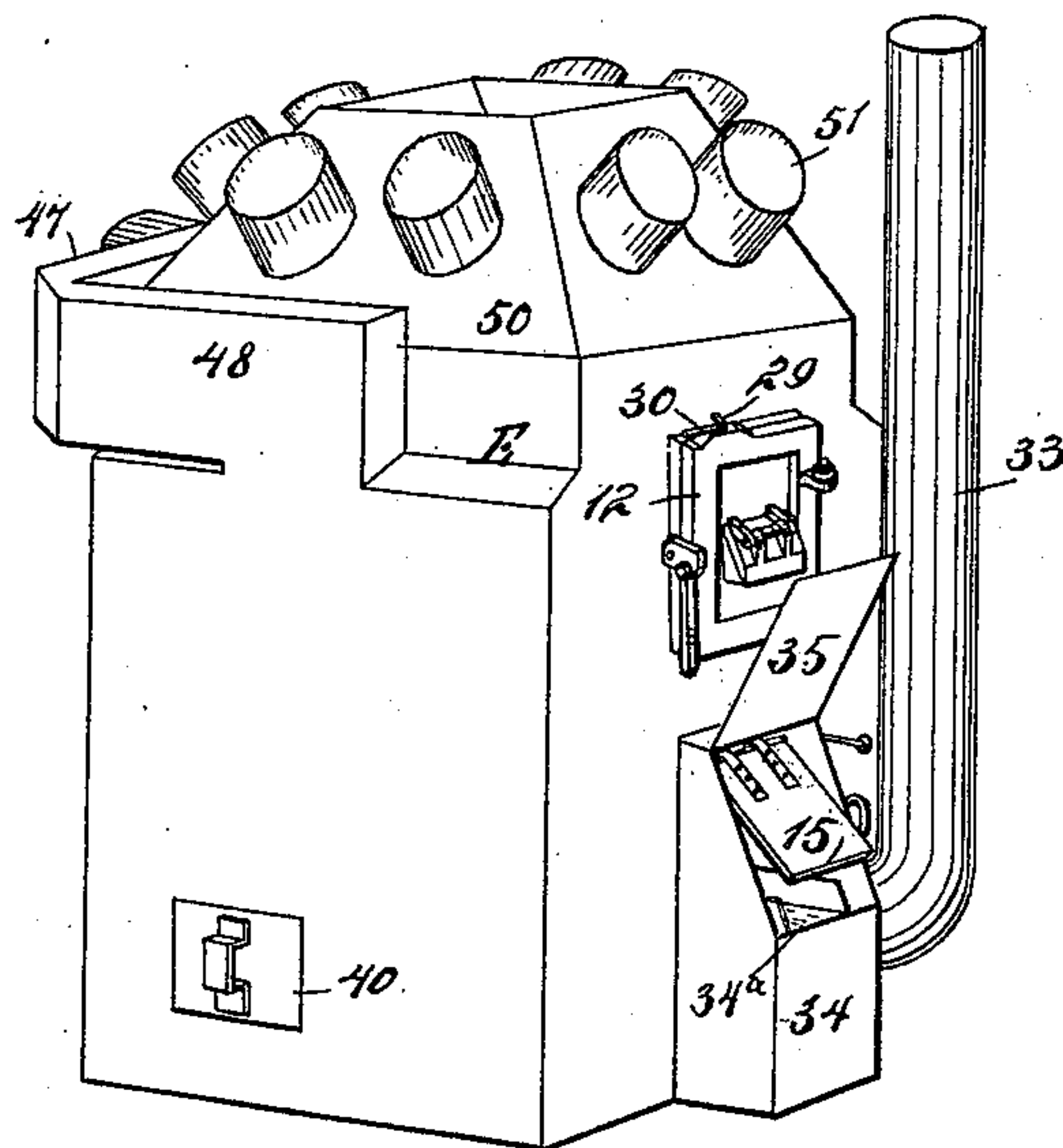
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E. E. STARR.  
FURNACE.

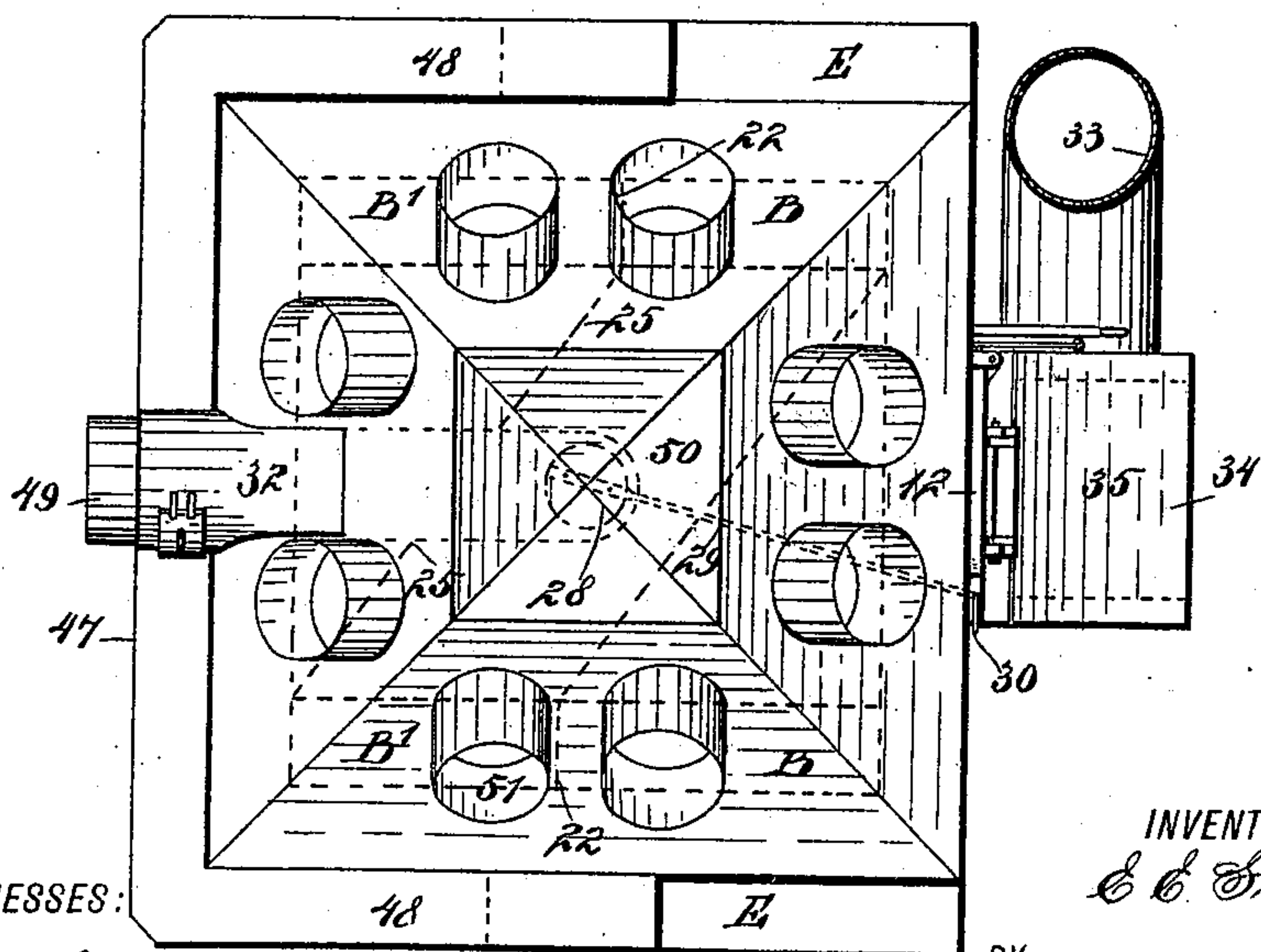
No. 602,372.

Patented Apr. 12, 1898.

*Fig. 1.*



*Fig. 2.*



**WITNESSES:**

Otto Spieth.  
Prodraker.

***INVENTOR***

E. E. Starr.

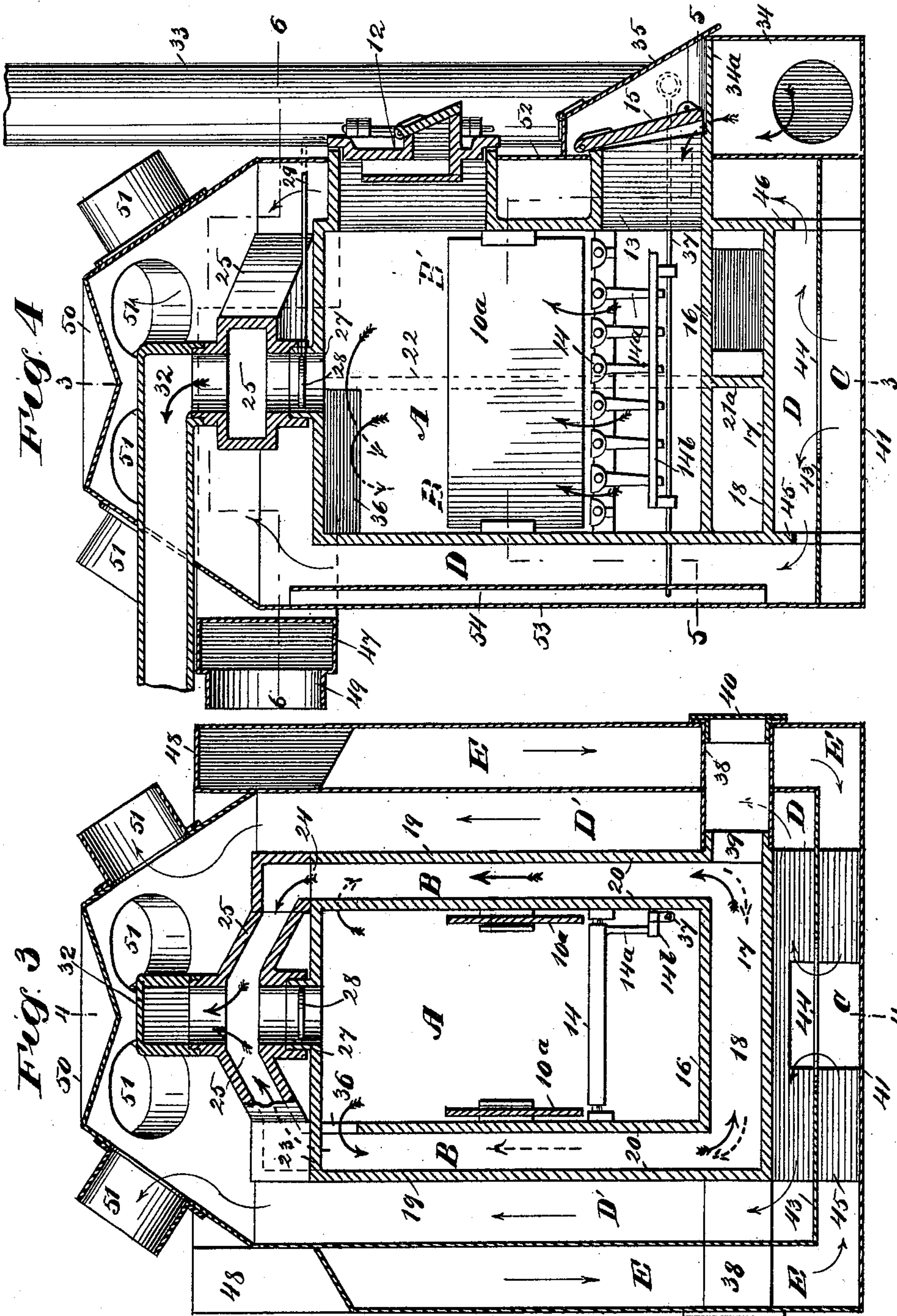
BY

**ATTORNEYS.**

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WITNESSES:  
*John A. Simpson*  
*John A. Simpson*

INVENTOR  
*E. E. Starr*  
BY  
*Munn & Co.*  
ATTORNEYS.



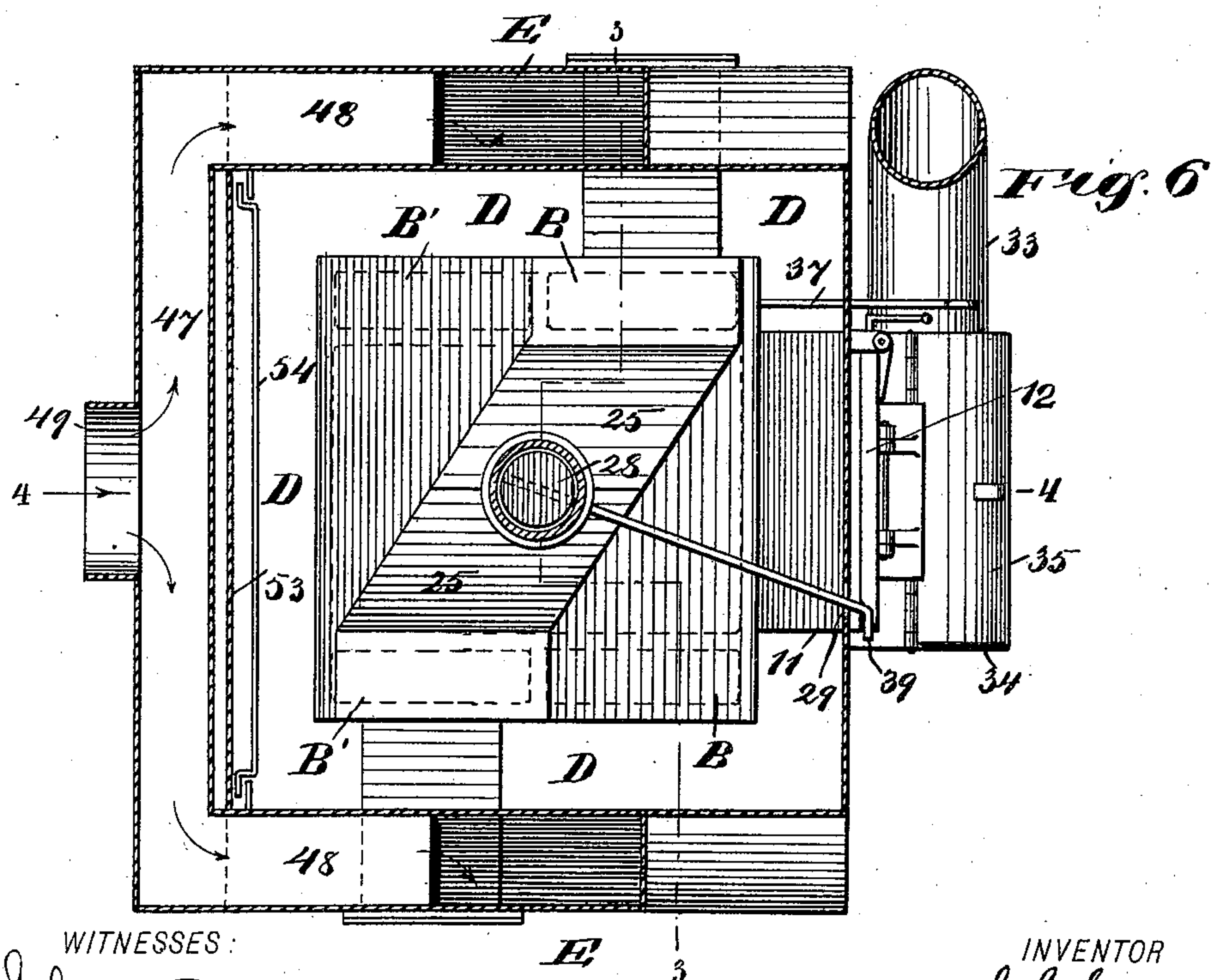
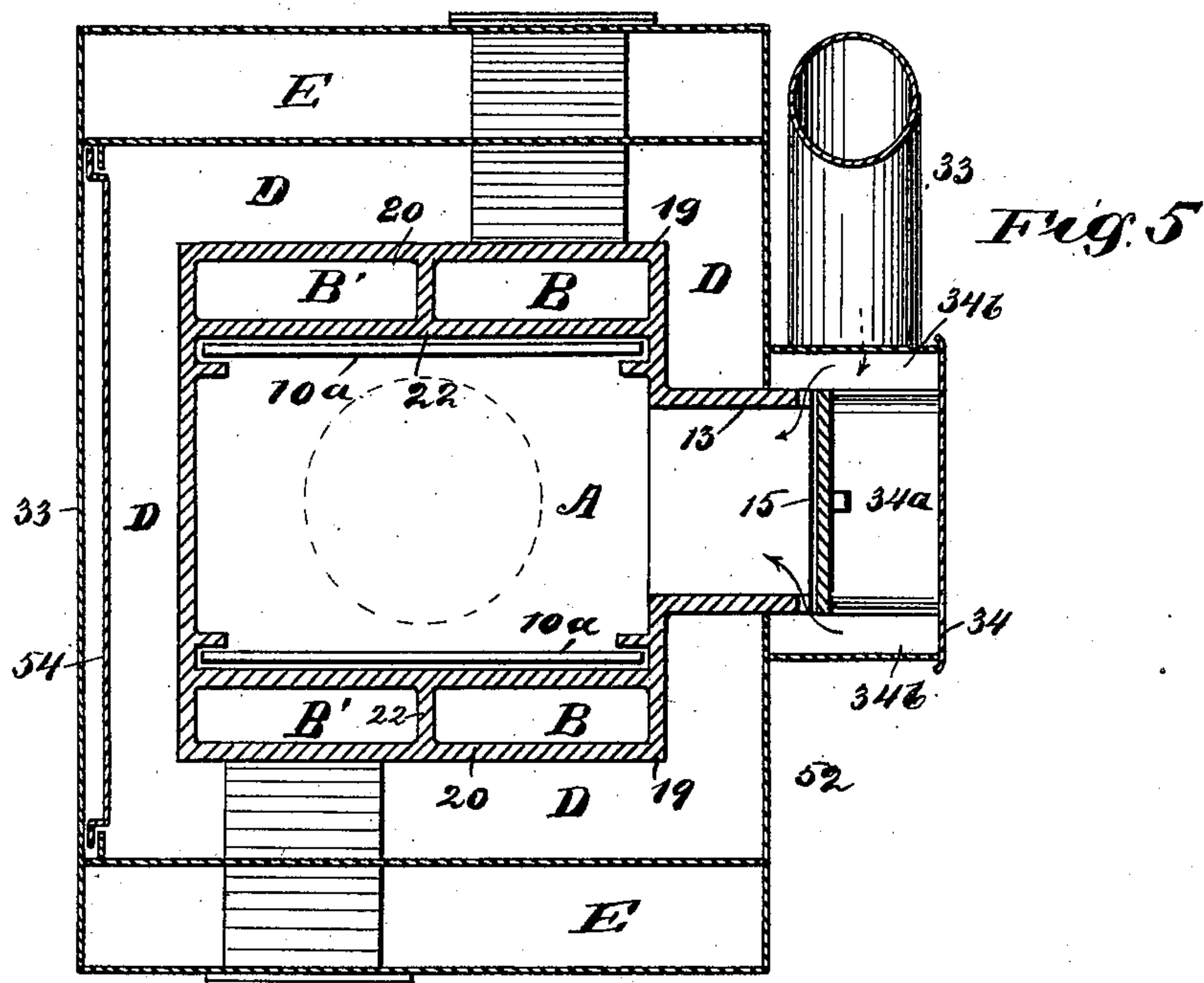
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E. E. STARR.  
FURNACE.

No. 602,372.

Patented Apr. 12, 1898.



WITNESSES:

*John Beitzham*  
*Photographer*

INVENTOR

*E. E. Starr*

BY

*Munn & Co.*

ATTORNEYS.



# UNITED STATES PATENT OFFICE.

EMORY E. STARR, OF BOWLING GREEN, OHIO.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 602,372, dated April 12, 1898.

Application filed June 12, 1897. Serial No. 640,489. (No model.)

*To all whom it may concern:*

Be it known that I, EMORY E. STARR, of Bowling Green, in the county of Wood and State of Ohio, have invented a new and useful Improvement in Furnaces, of which the following is a full, clear, and exact description.

The objects of the invention are to provide a furnace especially adapted for heating dwellings or similar places, and to so simplify the construction of the furnace that it can be made at a minimum of cost and to so construct and assemble the various parts of the furnace that the air intended to be conveyed to the rooms cannot by any possibility be brought in contact with the products of combustion and whereby the products of combustion are utilized to the greatest possible extent and all the heating-surface of the furnace will be brought into more or less direct contact with the air that is to be supplied to the rooms or apartments.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of the improved furnace. Fig. 2 is a plan view of the same. Fig. 3 is a vertical section taken practically on the line 3 3 of Fig. 4. Fig. 4 is a vertical section taken on the line 4 4 of Fig. 3. Fig. 5 is a horizontal section on the line 5 5 of Fig. 4, and Fig. 6 is a horizontal section on the line 6 6 of Fig. 4.

The fire-pot A of the furnace is provided with fire-plates 10<sup>a</sup>, which are removably placed at each side of said fire-pot to extend the lifetime of the latter, and near the upper portion at one side a throat-ring or box extension 11 is formed, which carries a fire-door 12 of any approved construction. At the same side or front of the fire-pot at the bottom a second outwardly-extending throat-ring or box extension 13 is provided, the major portion whereof is laid below the grate 14 of the fire-pot, and the box extension 13 is in direct communication with the ash-pit and is normally closed at its outer end by a door 15.

The fire-pot is provided with a main bottom 16, which constitutes the bottom of the ash-pit, and an auxiliary bottom 17, the front and back walls of the fire-pot being carried downward to the lower or auxiliary bottom 17, forming thereby a flue or compartment 18 beneath the main bottom 16. Outside of the fire-pot at each of its sides a wall or partition 19 is constructed, which is carried down and connects with the lower or auxiliary bottom 17. Under this arrangement two vertical side flues 20 are formed, which extend to the top of the fire-pot and are there closed by horizontal partitions 23. (Illustrated at the left in Fig. 3.) Each flue 20 is divided into two sections and form independent subflues B and B', the divisions being made through the medium of vertical partitions, (shown in Figs. 3 and 4,) and a corresponding partition 21<sup>a</sup> is located in the bottom flue 18, dividing it into two subflues, connecting one with each of the subflues B and B'. (Shown also in Figs. 3 and 4.) The subflues B and B' are smoke or combustion flues, and each is provided at the top with an outlet 24; but the outlet of the flue B is diagonally opposite the outlet of the flue B' and a single outlet only is provided for each complete flue. These outlets 24 connect with pipes or flues 25, located above the fire-pot, and the said flues or pipes 25 are brought together centrally over the fire-pot, being connected with the upper portion of the latter by a collar or sleeve 27, in which a damper 28 is pivoted, capable of closing the interior of the sleeve or collar and of opening direct communication between the fire-pot and the flues 25 where they meet.

The damper 28 is preferably operated automatically, being attached to a rod 29, which is carried out to the front of the furnace, terminating in a crank 30, as shown in Fig. 1, and when the fire-door 12 is closed the crank rests upon the top of the door and holds the damper 28 in such position as to prevent the products of combustion passing up directly from the fire-pot to the flues 25; but the moment that the fire-door is opened the crank 30 or the damper-handle will gravitate downward and the damper will be opened, establishing a direct communication between the direct draft in the interior of the fire-pot and the offtake 32 for the smoke, which pipe connects



with the two upper branch flues 25 immediately over the point where the damper 28 is placed, as shown in Fig. 4. The air is conducted to the fire through the pipe 33, which  
 5 connects with a box 34, the box being located at or near the base of the furnace at its front side, and the ash-pit door 15 will open into the said box. The box 34 is provided with a door 35, and when this latter door is opened  
 10 the ash-pit door may be opened out, so as to remove ashes from the furnace. In order that the ashes may be removed without dropping into the bottom of the box, a partition 34<sup>a</sup> is provided on a level with the bottom  
 15 of the ash-pit, having upwardly-flared sides to form a space 34<sup>b</sup> between said sides and the box.

The subflues B and B' are connected through the divisions of the bottom flue 18.  
 20 The flue B is provided with an opening 36 at its top, which is in direct communication with the fire-pot A, as shown in Figs. 3 and 4, and at the opposite side of the fire-pot a similar communication (not shown) is provided be-  
 25 tween the subflue B' and the fire-pot. The soot or other collected material may be readily cleaned from the bottom of the flue 18 by means of pipes 38, that extend outwardly from collars 39, which are built in the end  
 30 portions of the bottom flue 18, as shown particularly in Figs. 3 and 4, the said pipes being closed by removable covers 40. The grate-bars 14 are separate and independently piv-  
 35 oted, and the majority of the bars are provided with downwardly-extending arms 14<sup>a</sup>. The arms 14<sup>a</sup> are loosely entered into the plate 14<sup>b</sup>, secured to the shifting-rod 37, which extends beyond the front of the furnace.  
 40 The rocking motion that is given to the grate-bars under this arrangement imparts a better life to the fire than either a shaking or a revolving grate.

In operation the fire-door being closed the air will enter the box 34, pass up through the  
 45 openings 34<sup>b</sup> and through the ash-pit door when open or through the slides therein into the ash-pit, up through the bed of coals into the upper portion of the fire-pot, and out from the fire-pot through the openings 36 at  
 50 the top. The waste products of combustion thus discharged enter the subflues B and B', pass through the said flues downward to the bottom of the fire-pot proper at one side of the fire-pot, and through the connecting-flues  
 55 18 to the opposite side of the fire-pot, where the said products of combustion pass out from the flues B and B' through the openings 24, the products of combustion being conducted to the offtake-pipe 22 by the upper branch-  
 60 pipe flues 25. When, however, the fire-door is opened to view the fire or to add coal thereto, the damper 28, under the arrangement shown, will be opened and the gases and other products of combustion will pass directly  
 65 from the fire-pot into the offtake-flue, preventing any possibility of any of the gases backing out through the open fire-door.

A base 41 is provided for the furnace, which may be and usually is of sheet-iron, and be-  
 70 tween the base 41 and the bottom 17 of the outer casing for the fire-pot a horizontal partition 43 is located, having an opening 44 therein preferably at its center. Between  
 75 the base 41 and the partition 43 a chamber or a flue C is formed, and between the said partition 43 and the bottom 17 of the outer casing of the fire-pot a second flue D is produced,  
 80 as shown in Figs. 3 and 4. The flue C is of greater length than the flue D, and the flue D is in communication with an upright flue D', formed at each side of the outer casing of  
 85 the fire-pot mainly by placing box-flues E at each side of the furnace, the box-flues communicating at their lower ends with the horizontal flue C.

The fire-pot and the spaced outer wall 19 thereof, forming its outer casing, are preferably made of cast metal and may be cast in one piece, and are supported upon the base  
 90 41 by legs or divided bars 45 and 46, passed downward through the partition 43. These divided bars or legs form practically the front and rear walls for the flues C and D. The  
 95 flues C, D, D', and E are arranged to conduct the air which is to be heated and supplied to an apartment, while the flues 18, B, and B', as stated, are intended to receive and conduct  
 100 off the products of combustion.

The box-flues E, adapted to receive the air to be heated, together with the base 41 and  
 105 partition 43, the front sheet-iron partition 52 of the furnace, and the rear sheet-iron partition 53 practically constitute the jacket for the furnace. Both the front and the rear sheet-iron partitions 52 and 53 extend to the  
 110 base of the furnace, and the rear outer wall or partition 53 is carried upward to an engagement with the offtake-flue 32 for the smoke, having secured thereto a horizontal  
 115 air-inlet flue 47, which is at the rear of the furnace and is provided with branches 48, extending along the sides of the furnace and communicating with the box-flues E. Air is  
 120 admitted to the back flue 47 through the opening 49 made in its center, while a dome 50 forms the upper portion of the jacket of the furnace, the said dome being provided with  
 125 the usual collars 51, with which the heater-pipes are connected. The air to be heated is drawn in through the opening 49 and conducted by the back flue 47 and branch flues  
 130 48 to the side box-flues E. The air then enters the lower or base flue C, then the next upper flue D, and passes up through the vertical connecting-flues D' to the dome and  
 thence to the supply-pipes of the house or building. Thus it will be observed that the  
 air to be heated is passed entirely around the cast portion of the furnace, or that portion  
 which is provided to absorb and radiate the heat, and finds an exit from the furnace in a  
 highly-heated condition. The direction in which the products of combustion travel is  
 indicated by heavily-drawn arrows, while



lightly-drawn arrows indicate the path of the air to be heated.

In order to prevent the rear wall or partition 53 being affected by the heat, as such partition or wall is quite close to the fire-pot, a guard-plate 54 is provided, located between said wall or partition and the fire-pot, as shown in Fig. 4. The cleaning-tubes 38 are passed through the box-flues E and cross the upright flues D' for the heated air.

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

1. In a furnace, the combination, with a fire-pot, and an air-supply for the fire connected with the said fire-pot near the bottom, of a casing surrounding the fire-pot, forming vertical and horizontal combustion-conducting flues, each vertical flue having direct communication with the fire-pot near its upper portion, and each combustion-flue being provided with an outlet, exit-flues connected with the outlets of the combustion-flues, the exit-flues having a branch connected with the upper portion of the fire-pot, an offtake-flue connected with the exit-flues, and a damper located in the branch of the exit-flues between the said flues and the fire-pot, substantially as described.

2. In a furnace, the combination, with a fire-pot, an air-supply connected with the fire-pot beneath its grate, a casing for the fire-pot, forming upright and horizontally-connected flues for the products of combustion, the upright flues being provided with direct communication at their upper portions with the fire-pot, and being also provided at their tops with outlets, and a partition dividing the said

upright and horizontal flues into two separate compartments, of a main outlet for the products of combustion, branch pipes connected with the said main outlet and with the outlets of the vertical sections of the combustion-flues at the sides of the fire-pot, a connection between the branch pipes and the interior of the fire-pot at the top, a dome above the fire-pot, a flue for the air to be heated surrounding the fire-pot and its casing, and a fresh-air inlet connecting with the bottom portion of the air-heating flues, substantially as described.

3. In a furnace, the combination, with a fire-pot, an air-supply for the fire-pot, fire-plates removably attached to the fire-pot, combustion-flues at the sides of the fire-pot, being in communication therewith, an offtake for the products of combustion, branch pipes from the offtake connected with the said combustion-flues, and a branch connection between the branch pipes and the fire-pot, of a casing surrounding the fire-pot, provided with outer box air-inlet flues, inner flues located between the box-flues and the fire-pot, also adapted to conduct air to be heated, bottom air-flues in connection with each other, one bottom flue being connected with the box-flues and the other with the inner air-flues, a dome located over the fire-box, receiving the heated air from the inner flues, and means, substantially as described, for introducing cold air into the said box-flues and permitting an egress of the heated air from the dome, as described.

EMORY E. STARR.

Witnesses:

FRANK W. DUNN,  
A. R. KETCHUM.