

No. 629,478.

Patented July 25, 1899.

J. C. SWINDELL.  
GAS FURNACE.

(Application filed May 12, 1899.)

(No Model.)

4 Sheets—Sheet 1.

FIG. 1.

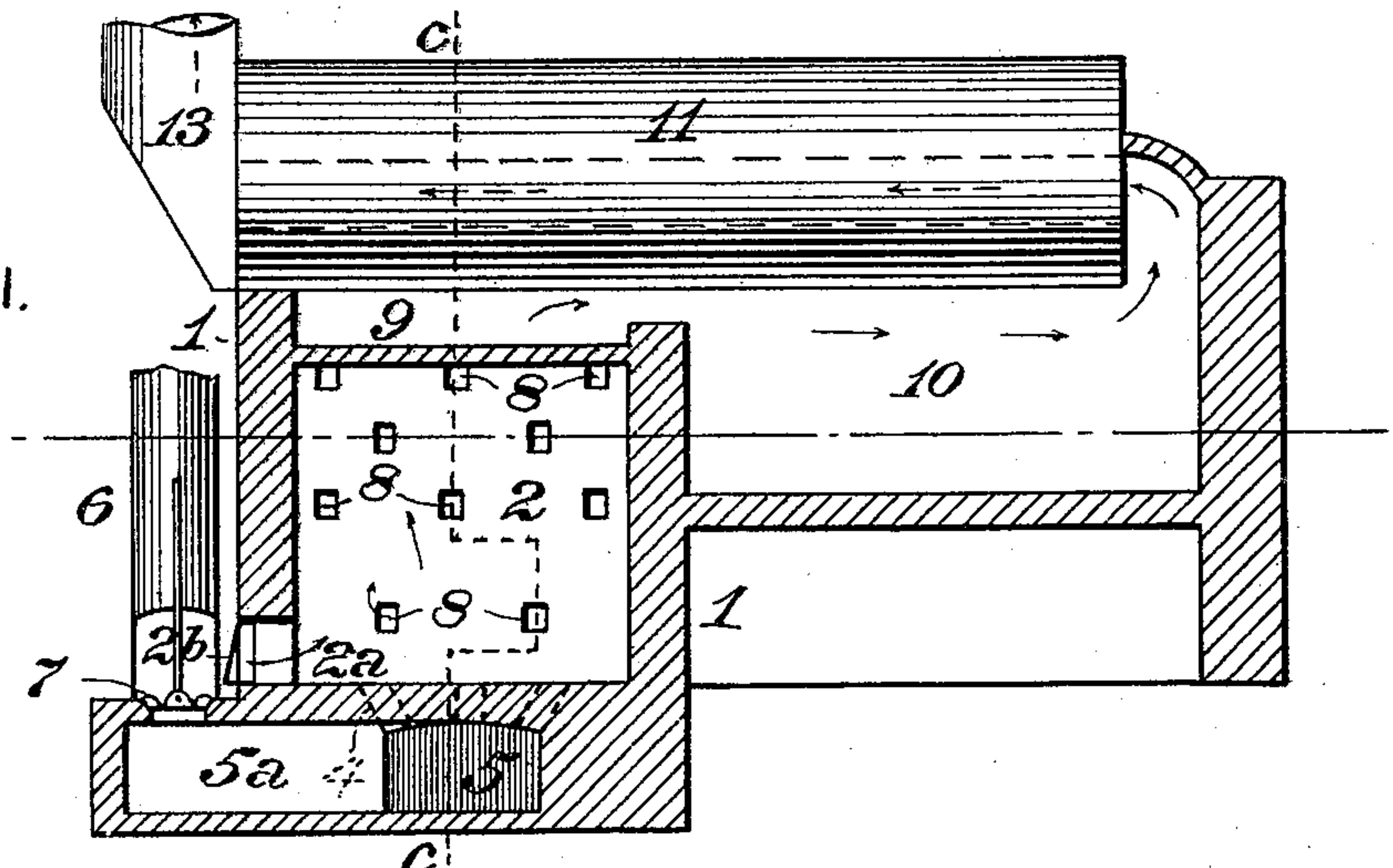


FIG. 2.

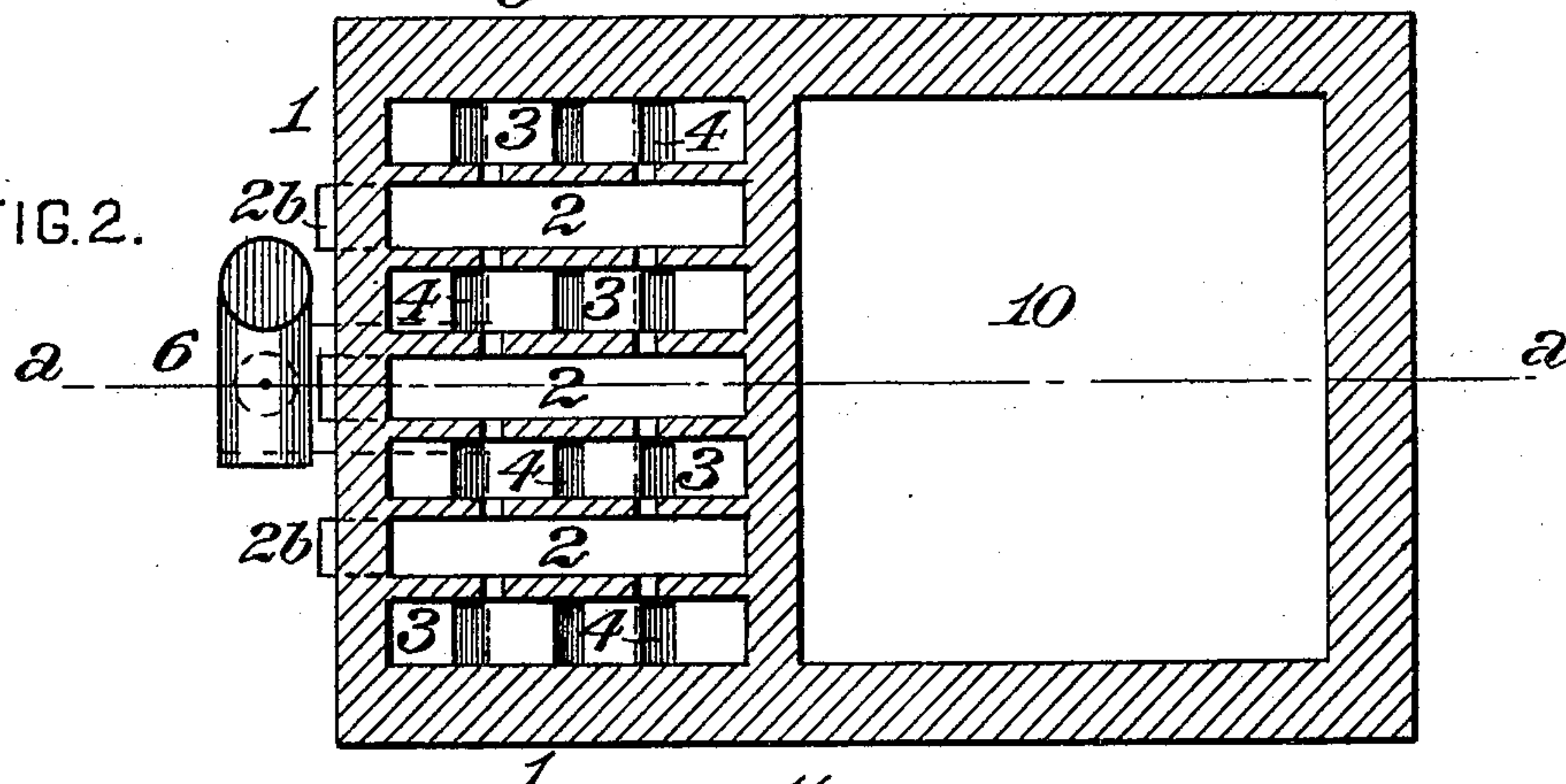
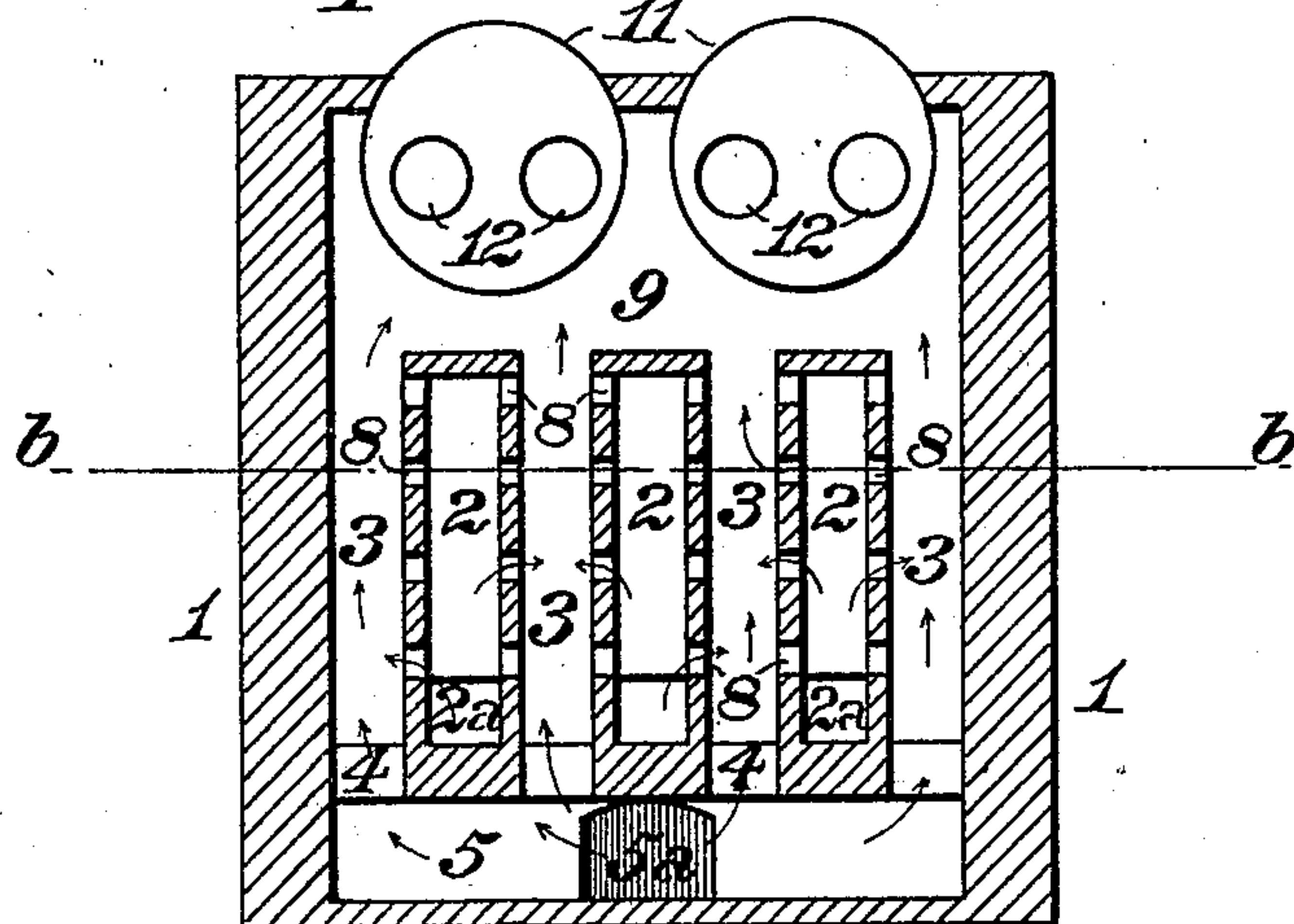


FIG. 3.



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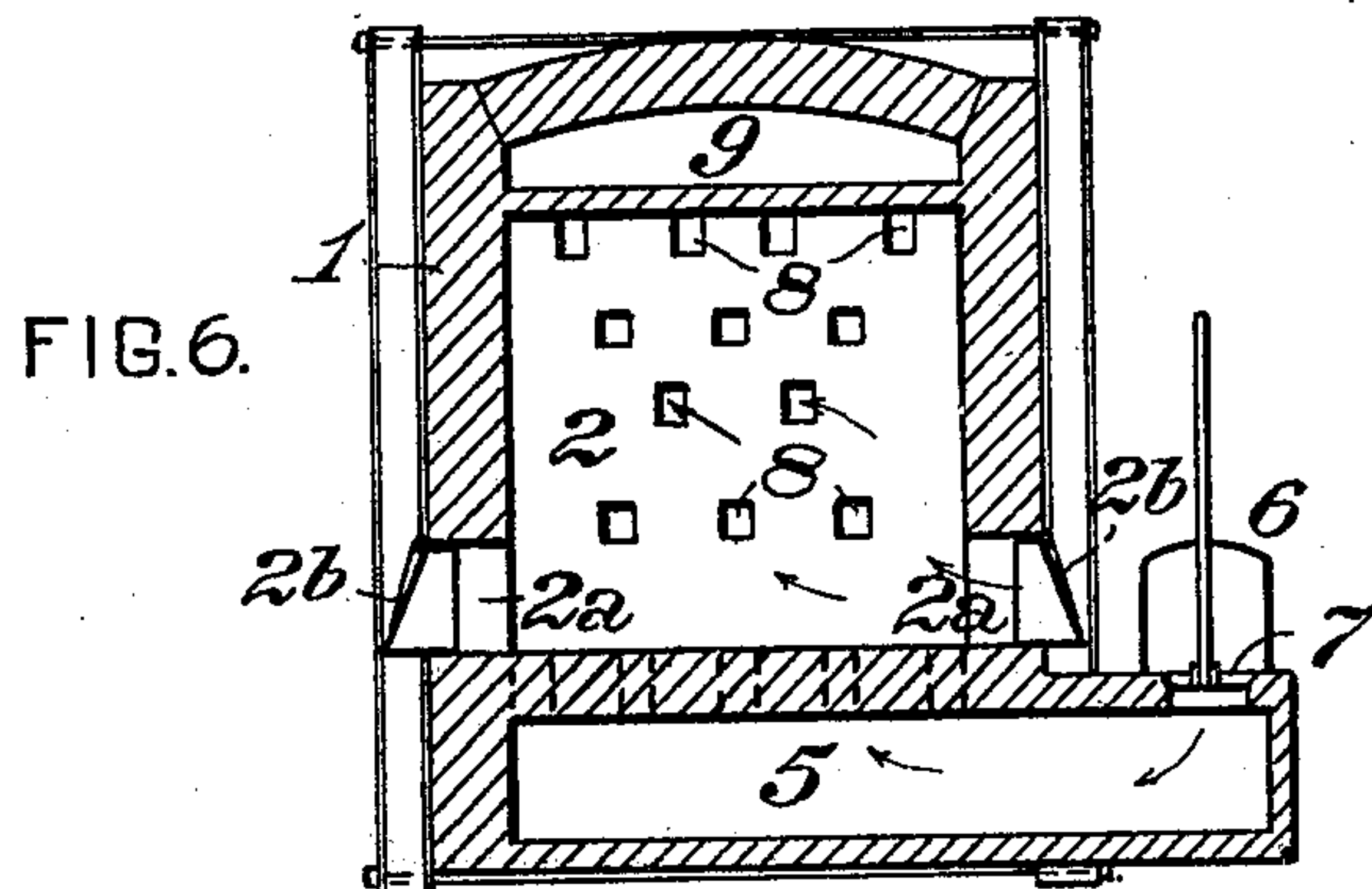
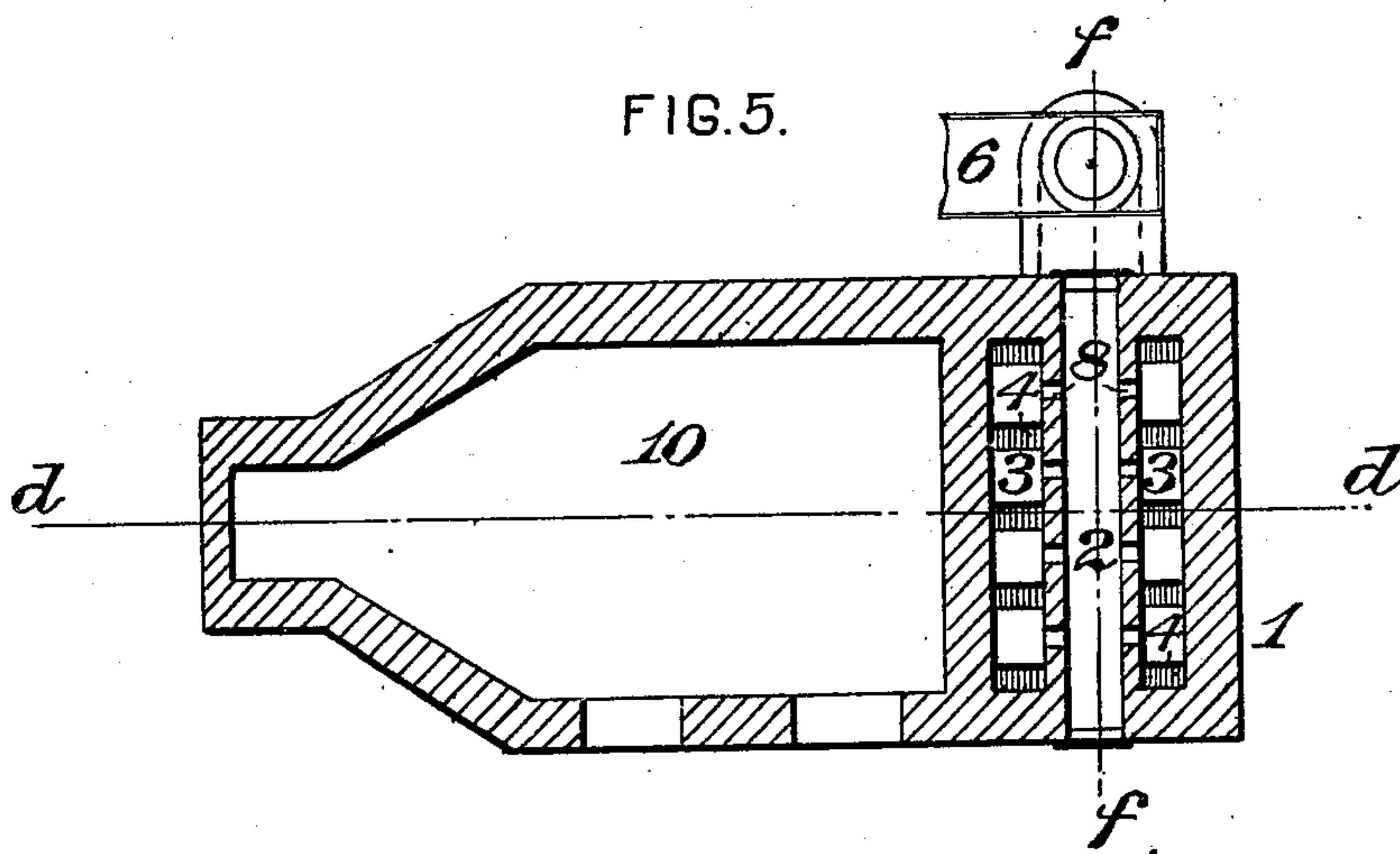
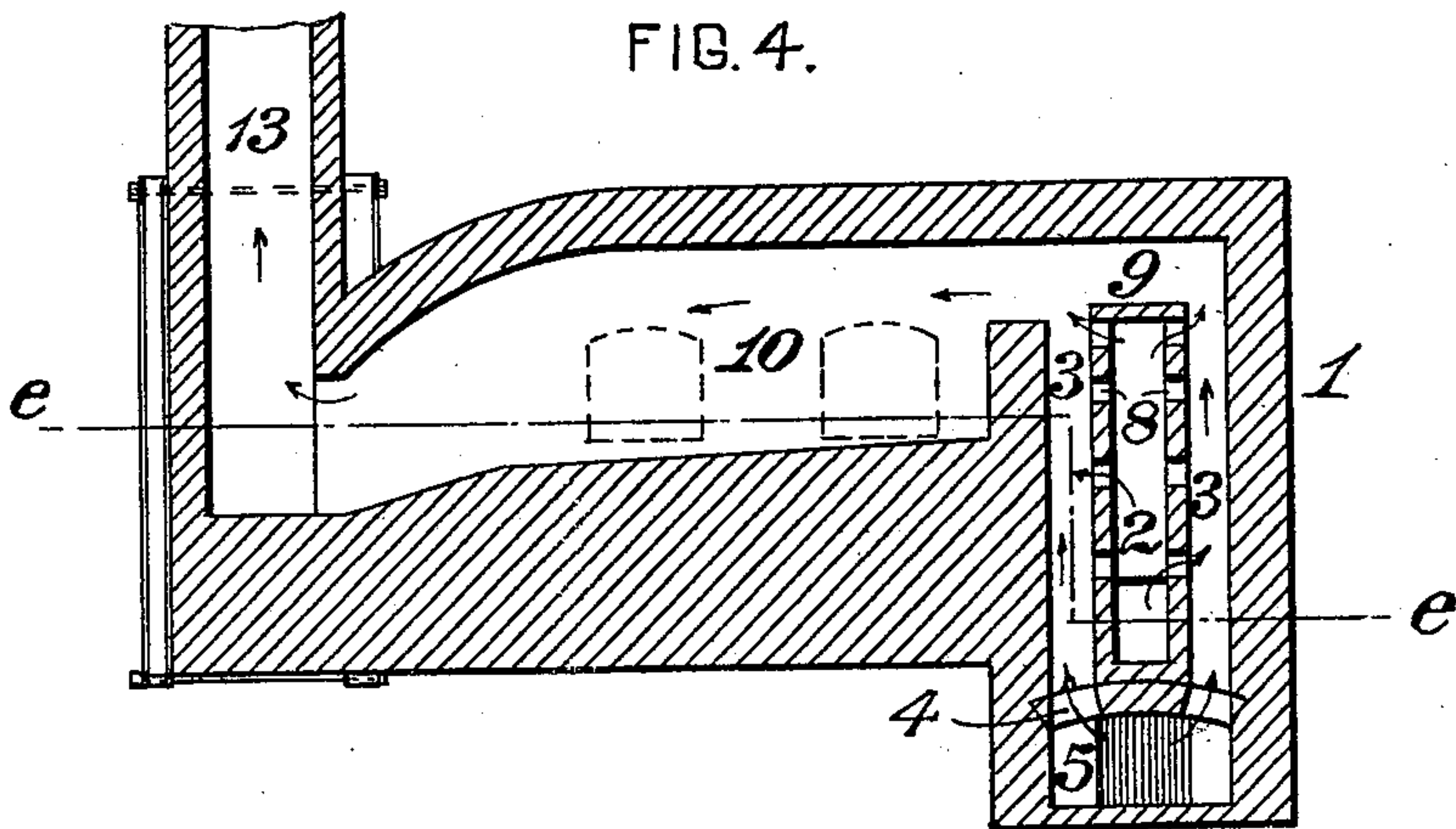
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4 Sheets—Sheet 2.



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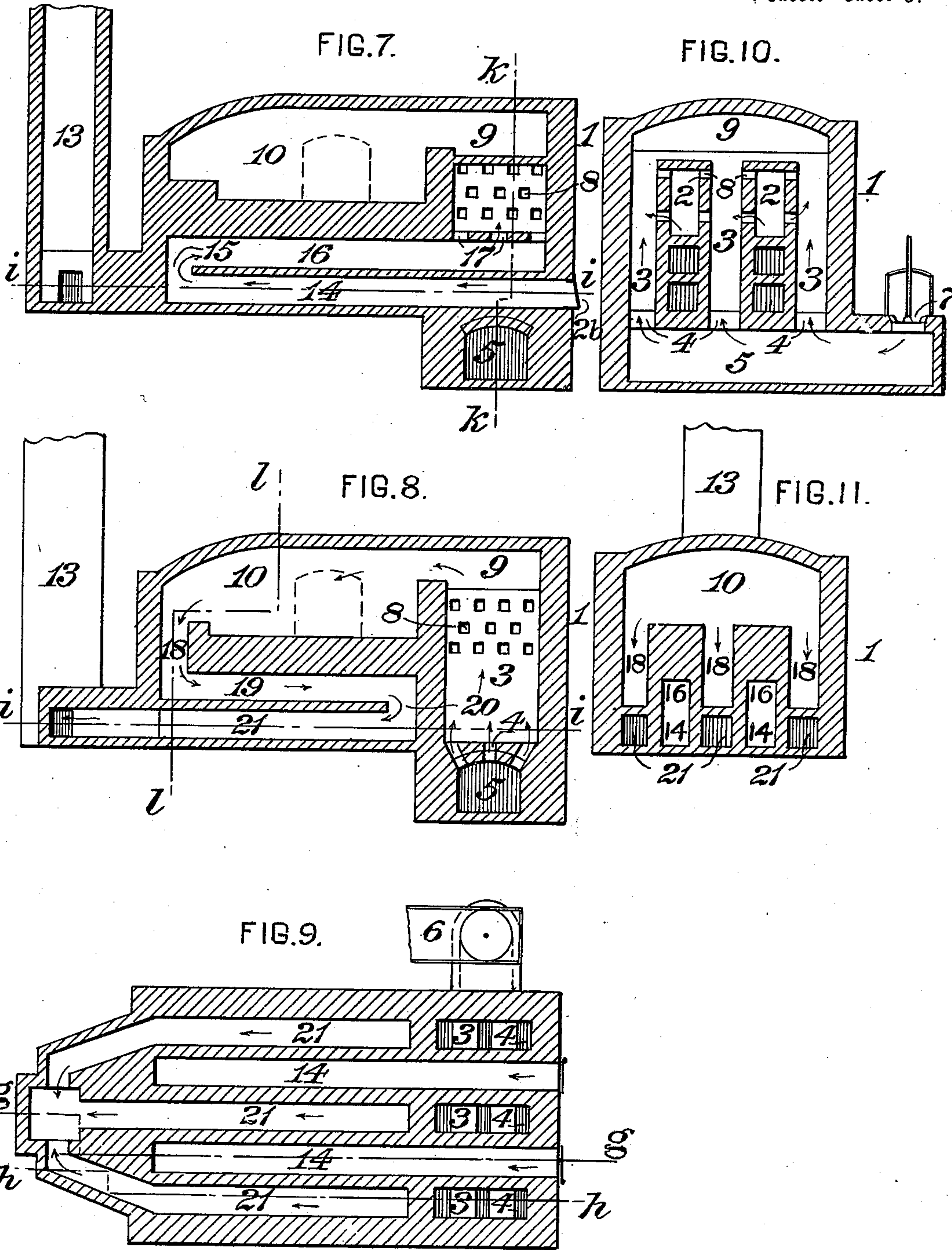
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## GAS FURNACE.

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4 Sheets—Sheet 3.



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No. 629,478.

Patented July 25, 1899.

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GAS FURNACE.

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(No Model.)

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FIG. 12.

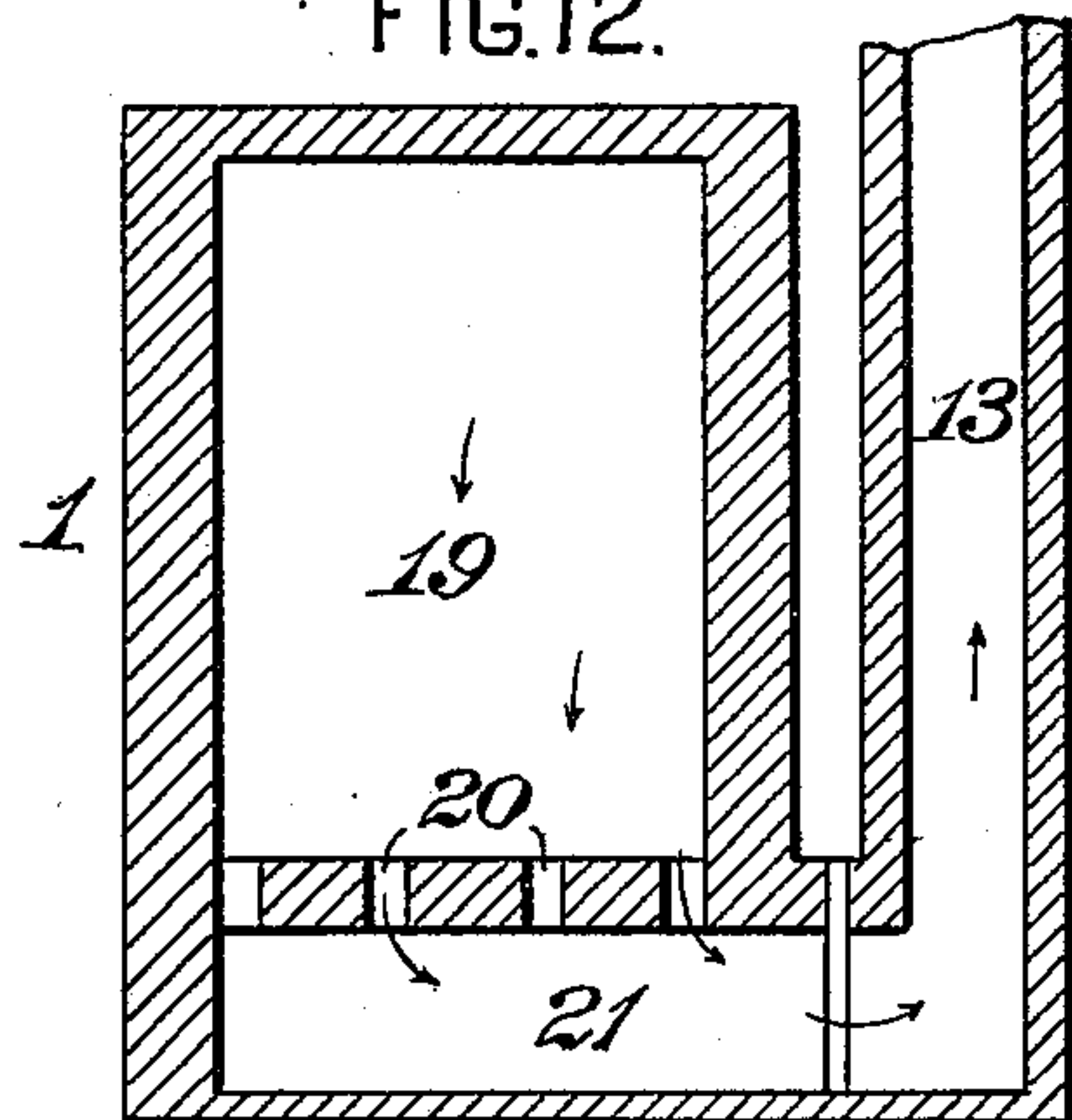


FIG. 13.

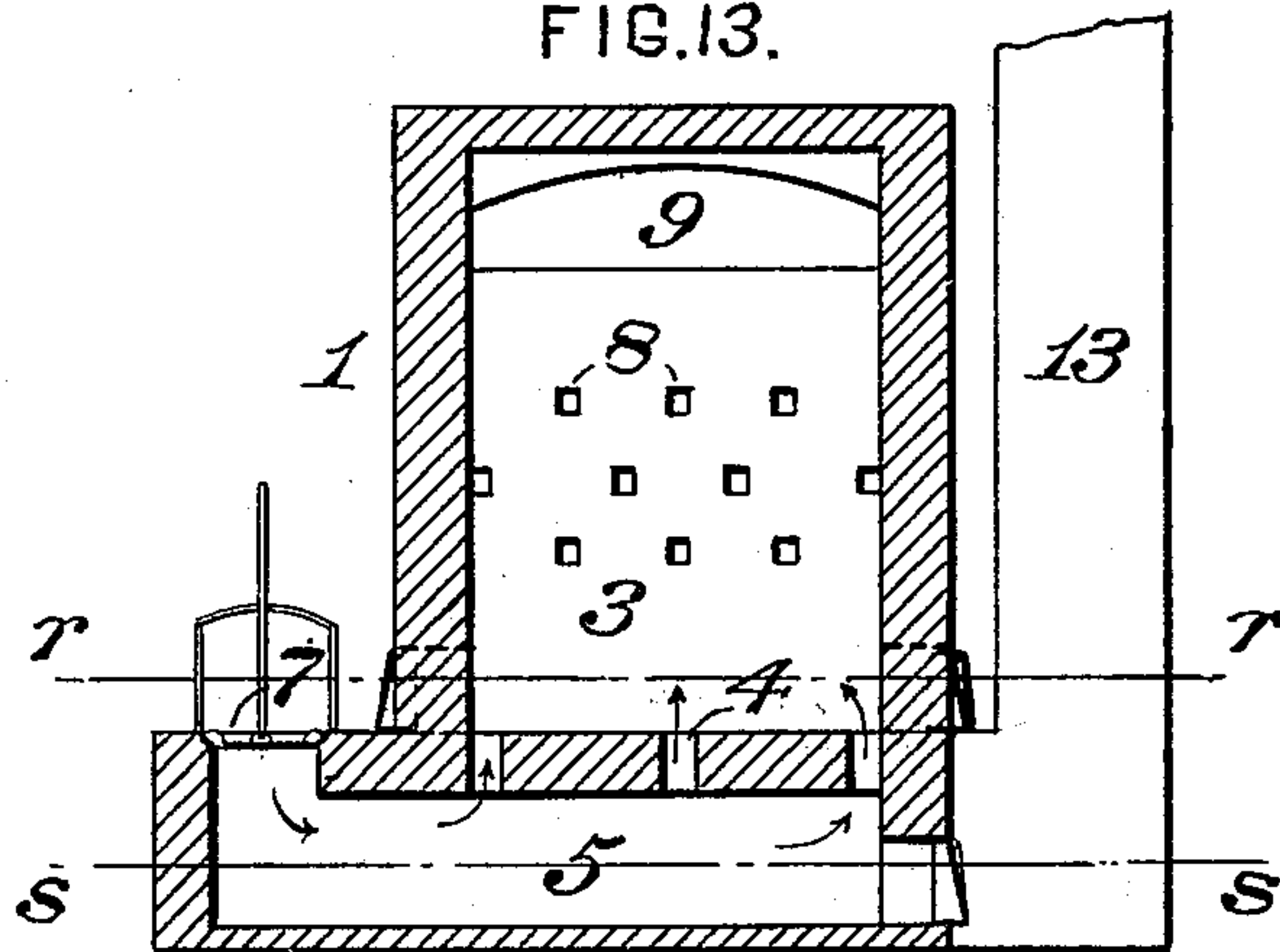


FIG. 15.

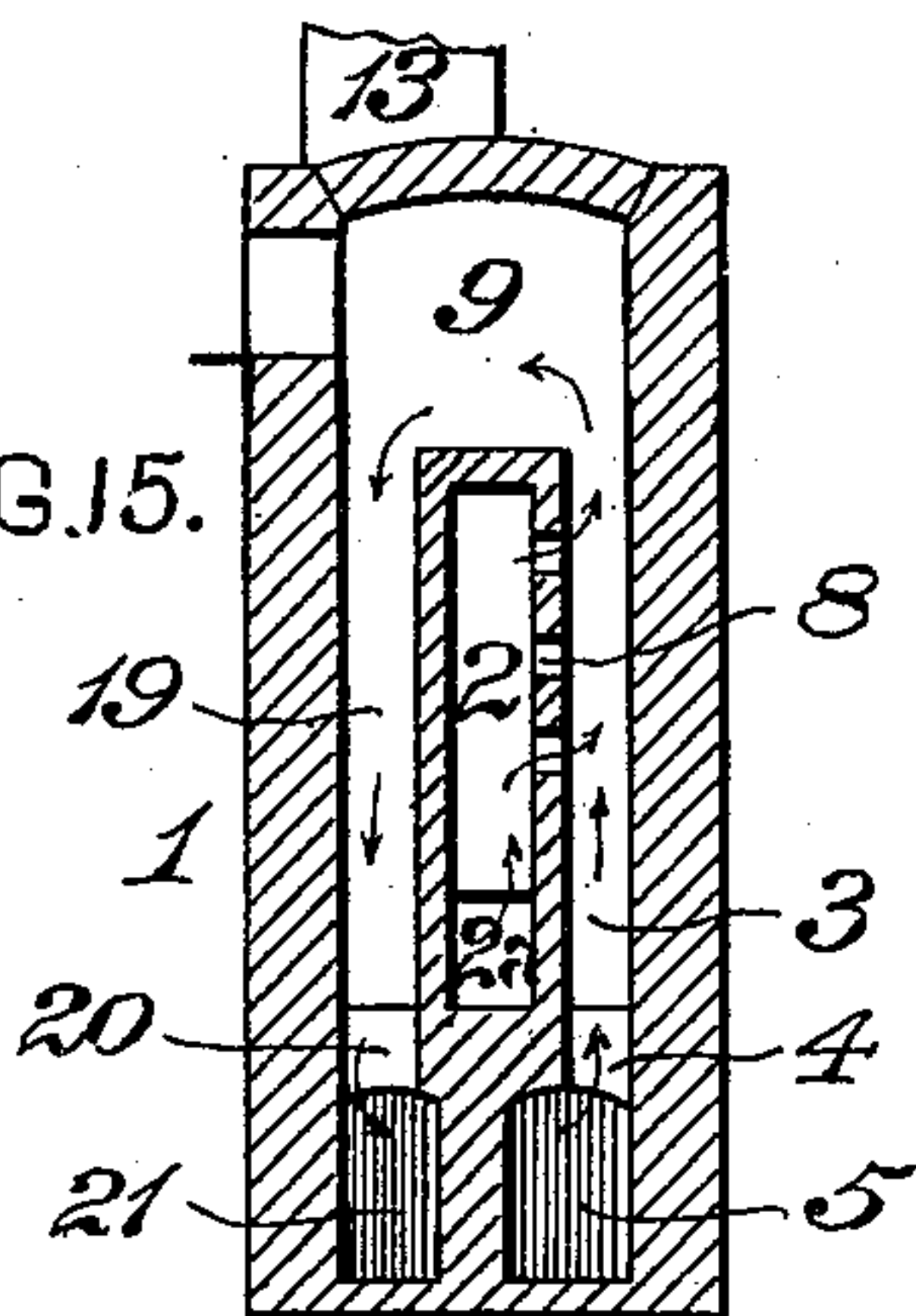


FIG. 16.

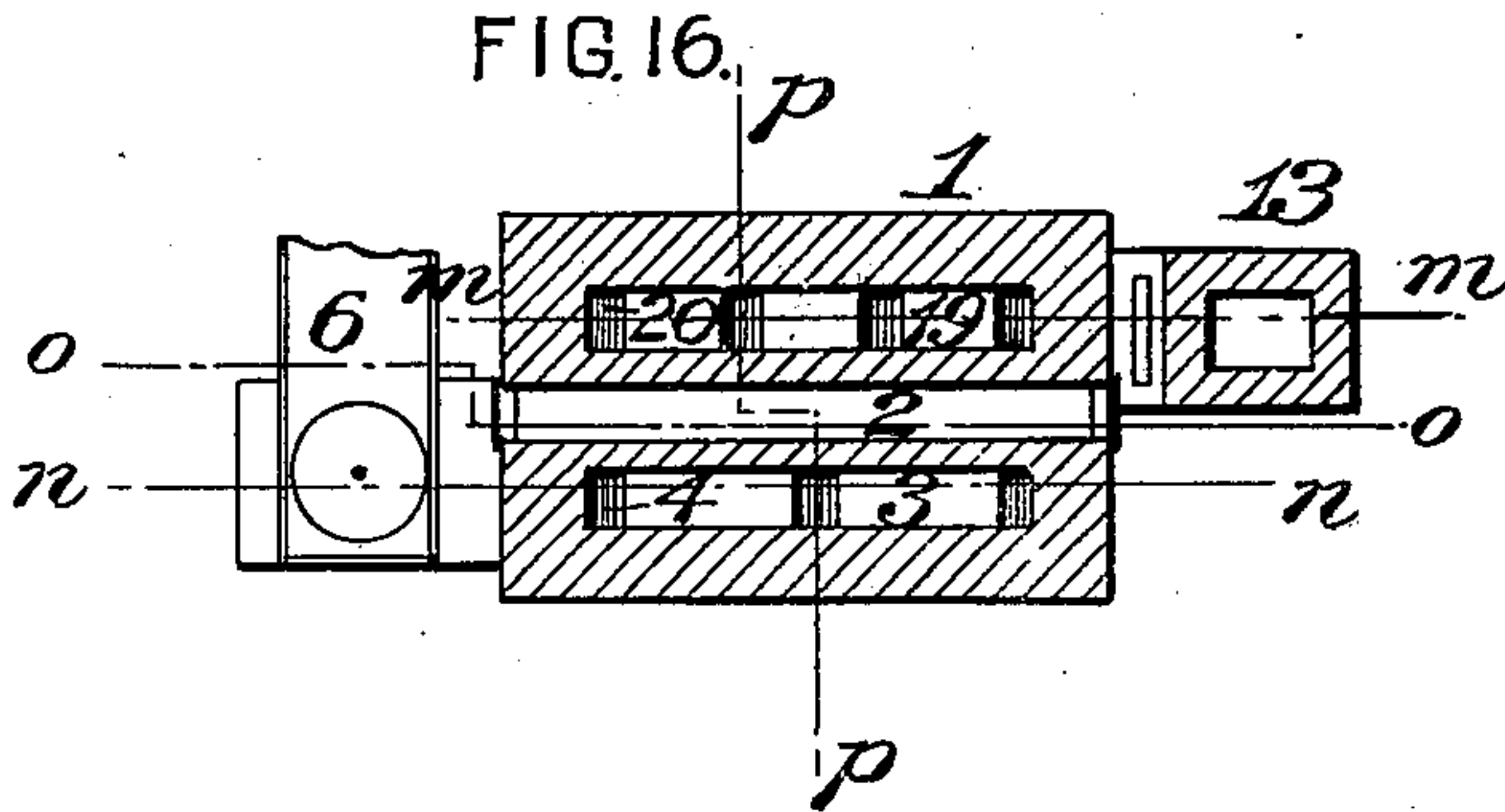


FIG. 14.

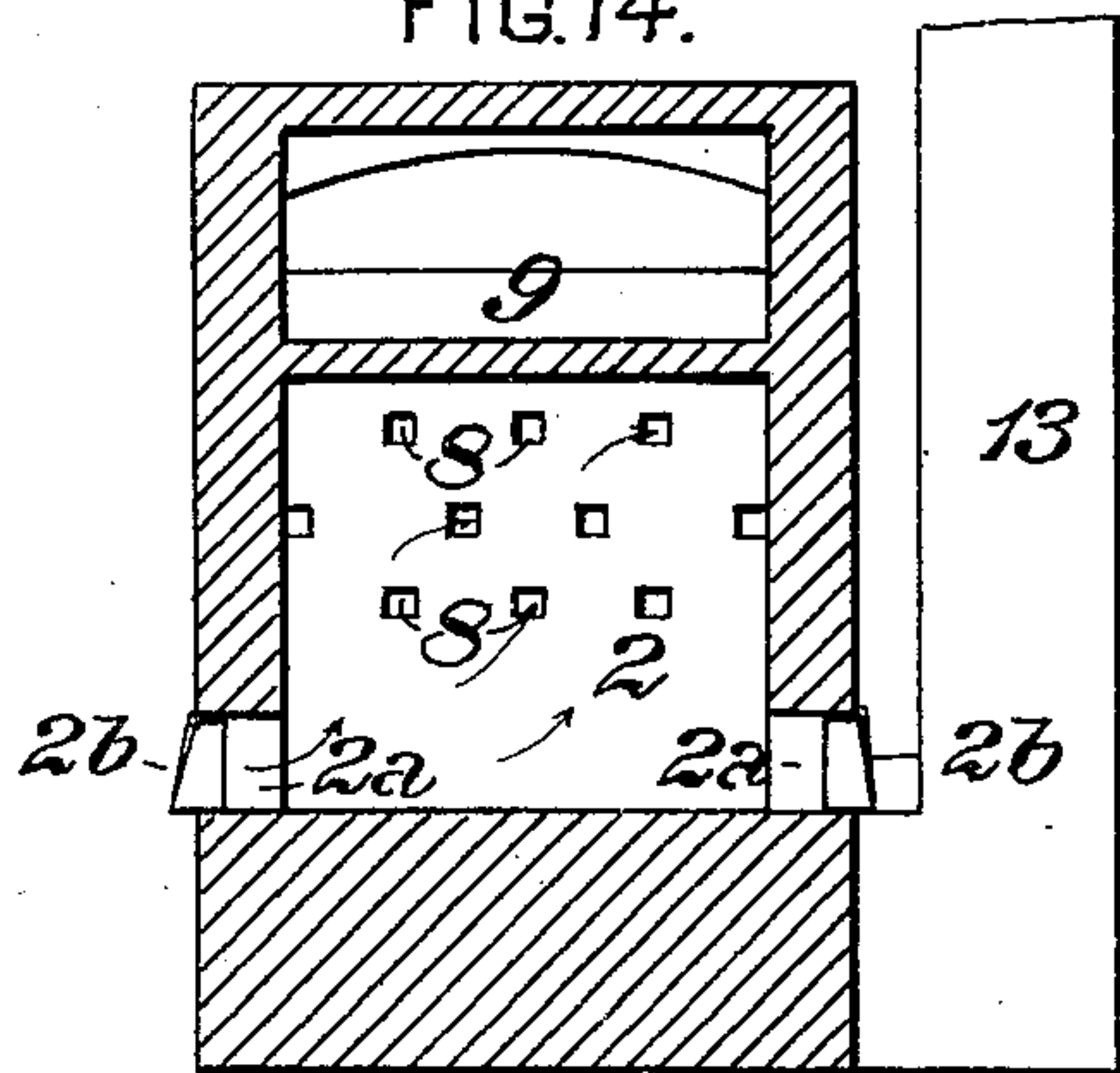
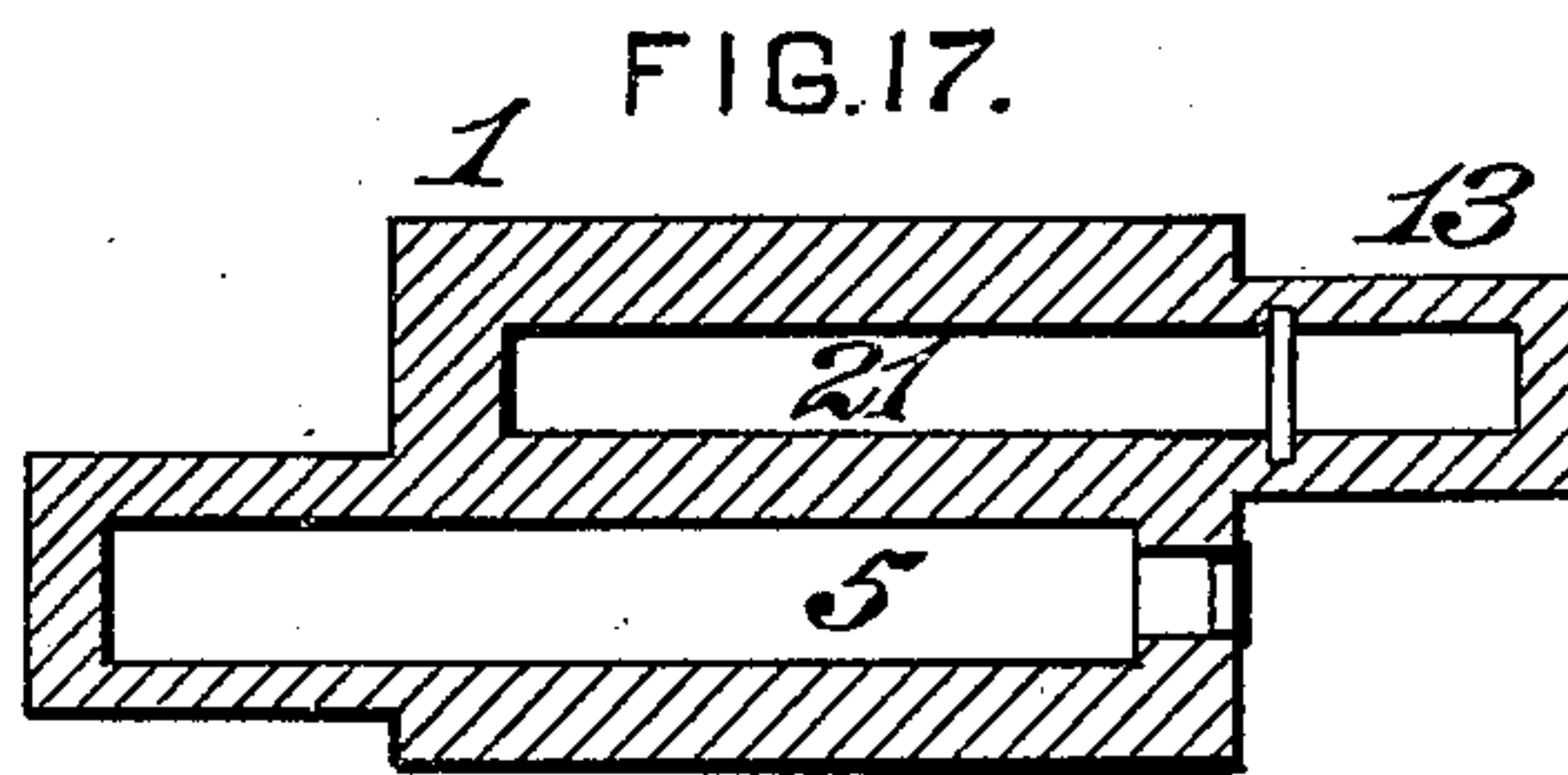


FIG. 17.



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# UNITED STATES PATENT OFFICE.

JOHN C. SWINDELL, OF ALLEGHENY, PENNSYLVANIA.

## GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 629,478, dated July 25, 1899.

Application filed May 12, 1899. Serial No. 716,595. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN C. SWINDELL, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Gas-Furnaces, of which improvement the following is a specification.

My invention relates to furnaces in which gaseous fuel is employed; and its object is to provide means for heating air supplied for effecting the combustion of gas which shall be simple and inexpensive in construction and readily applicable in connection with gas-furnaces of various types.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical longitudinal section through a construction illustrating an application of my invention in connection with a steam-boiler furnace, the section being taken at the line *a a* of Fig. 2; Fig. 2, a horizontal section through the same at the line *b b* of Fig. 3; Fig. 3, a vertical transverse section at the line *c c* of Fig. 1; Fig. 4, a vertical longitudinal section through a metallurgical furnace of the reverberatory type with my invention applied, the section being taken at the line *d d* of Fig. 5; Fig. 5, a horizontal section through the same at the line *e e* of Fig. 4; Fig. 6, a vertical transverse section at the line *f f* of Fig. 5; Fig. 7, a vertical longitudinal section through a metallurgical furnace of the same general type as that shown in Figs. 4 to 6, showing an application of my invention in connection with means for heating air by waste gases, the section being taken at the line *g g* of Fig. 9; Fig. 8, a similar section at the line *h h* of Fig. 9; Fig. 9, a horizontal section at the line *i i* of Figs. 7 and 8; Fig. 10, a vertical transverse section at the line *k k* of Fig. 7; Fig. 11, a similar section at the line *l l* of Fig. 8; Fig. 12, a vertical longitudinal section through a construction illustrating an application of my invention in connection with another form of metallurgical furnace, the section being taken at the line *m m* of Fig. 16; Fig. 13, a similar section at the line *n n* of Fig. 16; Fig. 14, a similar section at the line *o o* of Fig. 16; Fig. 15, a vertical transverse section at the line *p p* of Fig. 16; Fig. 16, a horizontal section at the

line *r r* of Fig. 13, and Fig. 17 a similar section at the line *s s* of Fig. 13.

Referring first to Figs. 1 to 3, inclusive, in the practice of my invention I construct within a suitable casing 1, of brick or masonry; which should be lined with fire-brick or other refractory material in the usual manner; one or more (in this instance three) vertical air supply and heating chambers 2, which are of substantially rectangular transverse section and are comparatively narrow or thin relatively to their length and height. Air is supplied to the chambers 2 through supply-ports 2<sup>a</sup>, controlled by doors or valves 2<sup>b</sup>. Each of the air-chambers 2 is adjoined on one or on both of its longitudinal sides by a gas-chamber 3, to which gas is supplied at its lower end through gas-supply ports 4, opening into a gas-supply flue or conduit 5, located below the gas chamber or chambers 3 and communicating through a connecting-flue 5<sup>a</sup> with a gas-supply pipe 6, leading from a producer or other source of supply and controlled by a valve 7. A plurality of air-delivery ports 8 is formed in the wall or walls of each of the air-chambers 2, which separates said chamber from the adjoining gas chamber or chambers, said air-delivery ports being located at different levels in said wall or walls and distributed at different points in the length of each of the air-chambers 2. The gas chamber or chambers 3 is or are open at top to a combustion-chamber 9, which may, as in the instance shown, communicate with a supplemental combustion-chamber 10. In this instance a battery of steam-boilers 11 is set in the combustion-chambers 9 and 10, and the products of combustion pass from said combustion-chambers through the flues 12 of the boilers to an exit flue or stack 13. In operation air is discharged from each of the air-chambers 2 through the air-delivery ports 8 into the adjoining gas-chambers 3, and the mixture of air and gas is ignited and burns at the outer ends of the ports 8. The larger portion of the air passes out through the upper ports, and the walls of the air-chambers becoming heated by the combustion at the levels of the lower ports impart their heat to the air as it passes through the air-chambers, and that portion which is delivered through the upper ports of the series becomes highly heated be-



fore its delivery to and admixture with the gas. The products of combustion exert their heat in the combustion-chamber which immediately communicates with the gas-chambers  
5 and in the connected furnace or combustion-chamber and are discharged from the latter into the stack.

Figs. 4 to 6, inclusive, illustrate the application of my invention in a manner similar  
10 in all essential particulars to that practiced in the construction above described in connection with a metallurgical furnace of the reverberatory type. In this instance only one air supply and heating chamber 2 is provided, and the supplemental combustion-  
15 chamber 10 constitutes the working chamber or furnace-chamber proper. The means for supplying air and gas, effecting the admixture thereof, heating the air, and applying  
20 the heat of the products of combustion are in each case similar to those first described. It will be obvious that, if desired, two or more air-chambers 2, each adjoined by a gas-chamber 3, may be employed without variation of  
25 operative principle.

As shown in Figs. 7 to 11 my invention is applied in a similar manner in connection with a furnace of the reverberatory type, but with the addition of means for preliminarily heating the air by the waste gases in their traverse from the furnace-chamber to the stack.  
30 The construction of the air-chambers 2, two of which are shown, and their communication with the gas-chambers 3 by the series of air-delivery ports 8 are the same as in the instances before described. The supply of air to the chambers 2 is in this instance effected through air-supply flues 14, the inlets or outer ends of which may be controlled by doors 2<sup>b</sup>,  
40 said flues extending longitudinally below the air and gas chambers and the furnace-chamber and communicating, by ports 15 at their inner ends, with superposed return-flues 16, the opposite ends of which communicate, by  
45 ports 17, with the bottoms of the air-chambers 2. The products of combustion escape from the furnace-chamber 10 through ports 18 at the end thereof farther from the air and gas chambers into longitudinal waste-flues  
50 19, the opposite ends of which communicate, by ports 20, with lower return waste-flues 21, leading to the stack 13. The waste-flues 19 21 are located immediately adjoining the air-supply flues 14 16, and the currents of air which  
55 pass through said air-supply flues to the air-chambers 2 are preliminarily heated by the waste products of combustion passing out through the waste-flues 19 21.

Figs. 12 to 17, inclusive, illustrate an application of my invention in a metallurgical furnace adapted for heating comparatively small bodies of metal and exemplify an air-chamber one side of which is heated by the combustion of a mixture of gas and air and  
65 the other by the waste products of combustion. In this instance but one air supply and heating chamber 2 is provided, this being of

the same form and proportions as those of the constructions previously described—that is to say, set vertically, of substantially rectangular transverse section, and comparatively  
70 narrow or thin relatively to its length and height. The air-chamber 2 is interposed between and immediately adjoins a gas-chamber 3, with which, as in the previous instances,  
75 it communicates by a plurality of air-delivery ports 8, and which is open at its top to the combustion or furnace chamber 9 and a waste-flue 19, leading downwardly from the furnace-chamber 9. The gas-chamber 3 and waste-  
80 flue 19 are closed on their outer sides by the walls of the setting 1. Air is supplied to the air-chamber 2 through supply-ports 2<sup>a</sup>, controlled by doors 2<sup>b</sup>, and gas is supplied to the gas-chamber 3 from a gas-supply pipe 6, controlled by a valve 7, which when open establishes communication between the pipe 6 and  
85 a gas-supply flue 5, located below the gas-chamber 3, and communicating therewith by ports 4 in its floor. The waste-flue 19 communicates by ports 20 with a lower horizontal waste-flue 21, leading to the stack 13. If  
90 desired, the construction shown may be duplicated—that is to say, an additional air-chamber 2 and waste-flue 19 may be employed—the gas-chamber 3 being intermediate between the two air-chambers, and the waste products being discharged at opposite  
95 sides of the combustion-chamber, so that one side of each air-chamber shall be exposed to their heat. Again, a plurality of air-chambers, with interposed gas-chambers, as in Figs. 1 to 3, may be provided and waste-flues  
100 19 be led downwardly from each side of the combustion-chamber, so that the heat of the escaping products may act upon the adjacent sides of the two outer air-chambers. In operation the gas is ignited at the ports 8 of the air-chamber 2, and the air supplied thereto is heated by the combustion of the mixture of  
105 gas and air on that side of the air-chamber, as in the previous instances, and is also heated by the waste products of combustion in their traverse through the waste-flue 19, immediately adjoining the opposite side of the  
110 air-chamber.

The essential and characteristic feature of my invention, as exemplified in the several constructions herein described and shown,  
120 consists in the provision of one or more vertical air heating and supply chambers, communicating by a plurality of air-delivery ports with an adjoining gas chamber or chambers, whereby the air supplied for admixture with the gas is heated in its traverse through the  
125 air chamber or chambers by the combustion of the mixture of gas and air in the adjoining gas chamber or chambers and also in the provision of means whereby the air may be likewise heated by the waste products of combustion in their traverse to a discharge flue  
130 or stack.

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



1. In a gas-furnace, the combination of a vertical air supply and heating chamber, a gas-chamber adjoining said air-chamber, a plurality of air-delivery ports, located at different levels in the wall separating the air and gas chambers, means for supplying air and gas respectively to said chambers at or near their lower ends, and a combustion-chamber communicating with the gas-chamber.

2. In a gas-furnace, the combination of a plurality of vertical air supply and heating chambers, a plurality of gas-chambers, each adjoining one of said air-chambers, air-delivery ports located at different levels in the walls separating the air and gas chambers, means for supplying air and gas respectively to said chambers at their lower ends, and a combustion-chamber located above and communicating with each of the gas-chambers.

3. In a gas-furnace, the combination of a plurality of vertical air supply and heating chambers, a plurality of gas-chambers, each adjoining one of said air-chambers, air-delivery ports located at different levels in the walls separating the air and gas chambers, means for supplying air and gas respectively

to said chambers at their lower ends, a combustion-chamber located above and communicating with each of the gas-chambers, and means for heating air supplied to the air-chambers by the waste products in their traverse from said combustion-chamber to a discharge flue or stack.

4. In a gas-furnace, the combination of a vertical air supply and heating chamber, a gas-chamber adjoining one side of said air-chamber, a plurality of air-delivery ports located at different levels in the walls separating the air and gas chambers, means for supplying air and gas respectively to said chambers at or near their lower ends, a combustion-chamber located above and communicating with the gas-chamber, and a waste-flue leading downwardly from said combustion-chamber and adjoining the air-chamber on the side thereof farther from the gas-chamber.

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