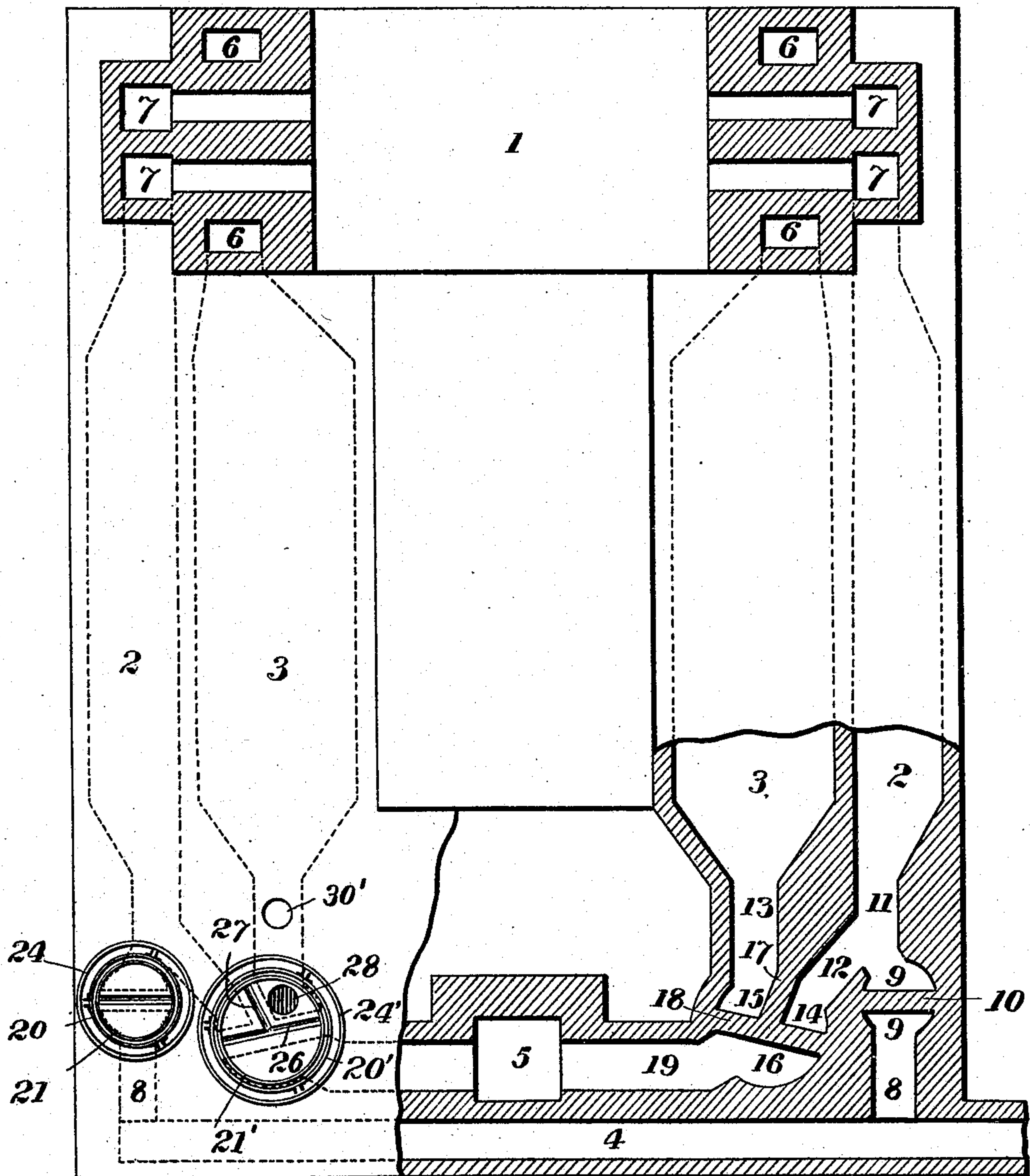


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 FLUE AND VALVE SYSTEM FOR REGENERATIVE FURNACES.  
 APPLICATION FILED MAR. 15, 1909.

936,931.

Patented Oct. 12, 1909.  
 4 SHEETS—SHEET 1.

Fig. 1.



Witnesses

*J. P. Linkel*  
*E. P. Corbett*

Inventor  
**Jacob B. McKennan**

by *Eugene C. Brown*  
 Attorney

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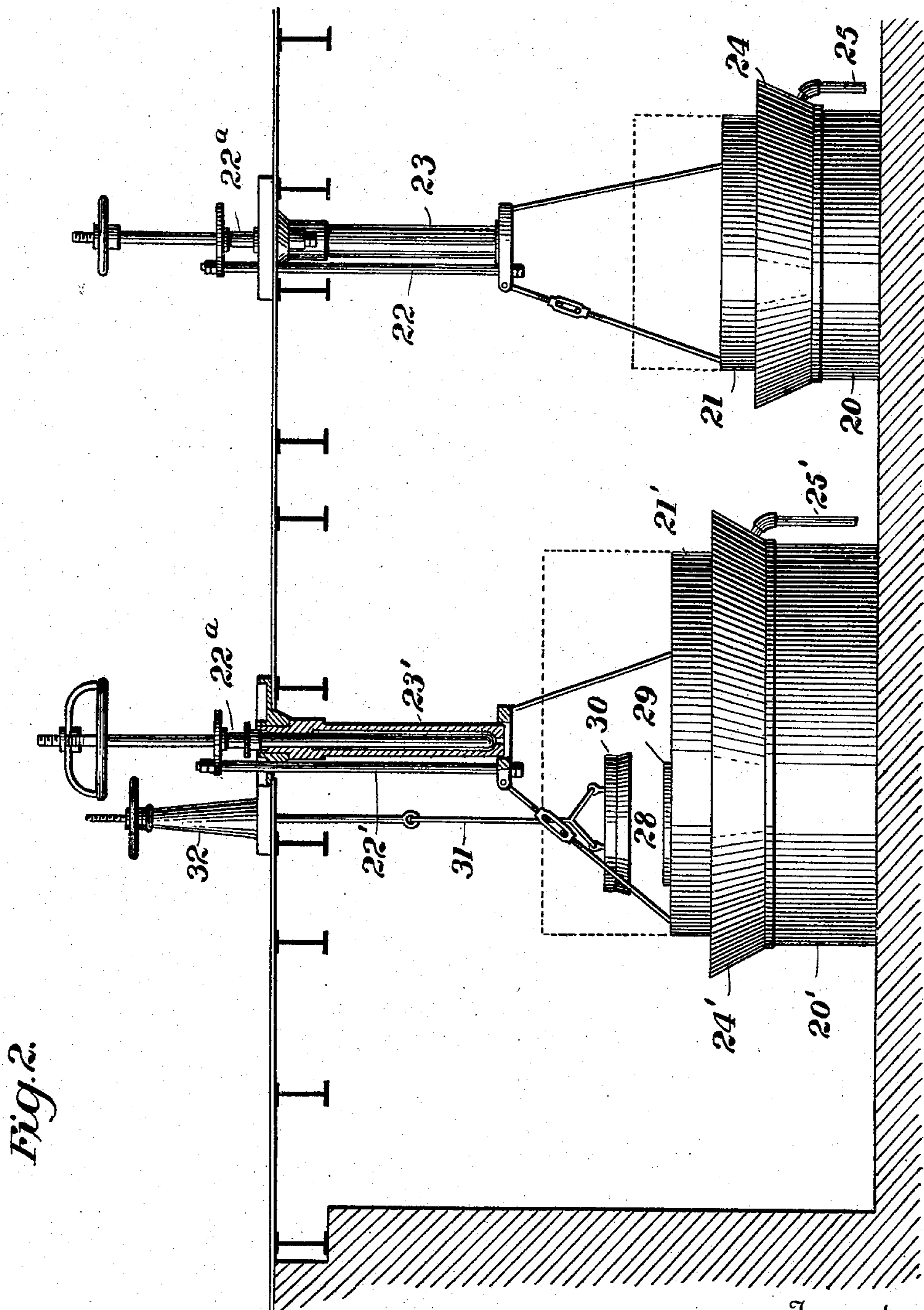


Fig. 2.

Witnesses  
*J. P. Linkel*  
*E. P. Corbett*

Inventor  
**Jacob B. McKennan**  
 by *Eugene C. Brown*  
 Attorney

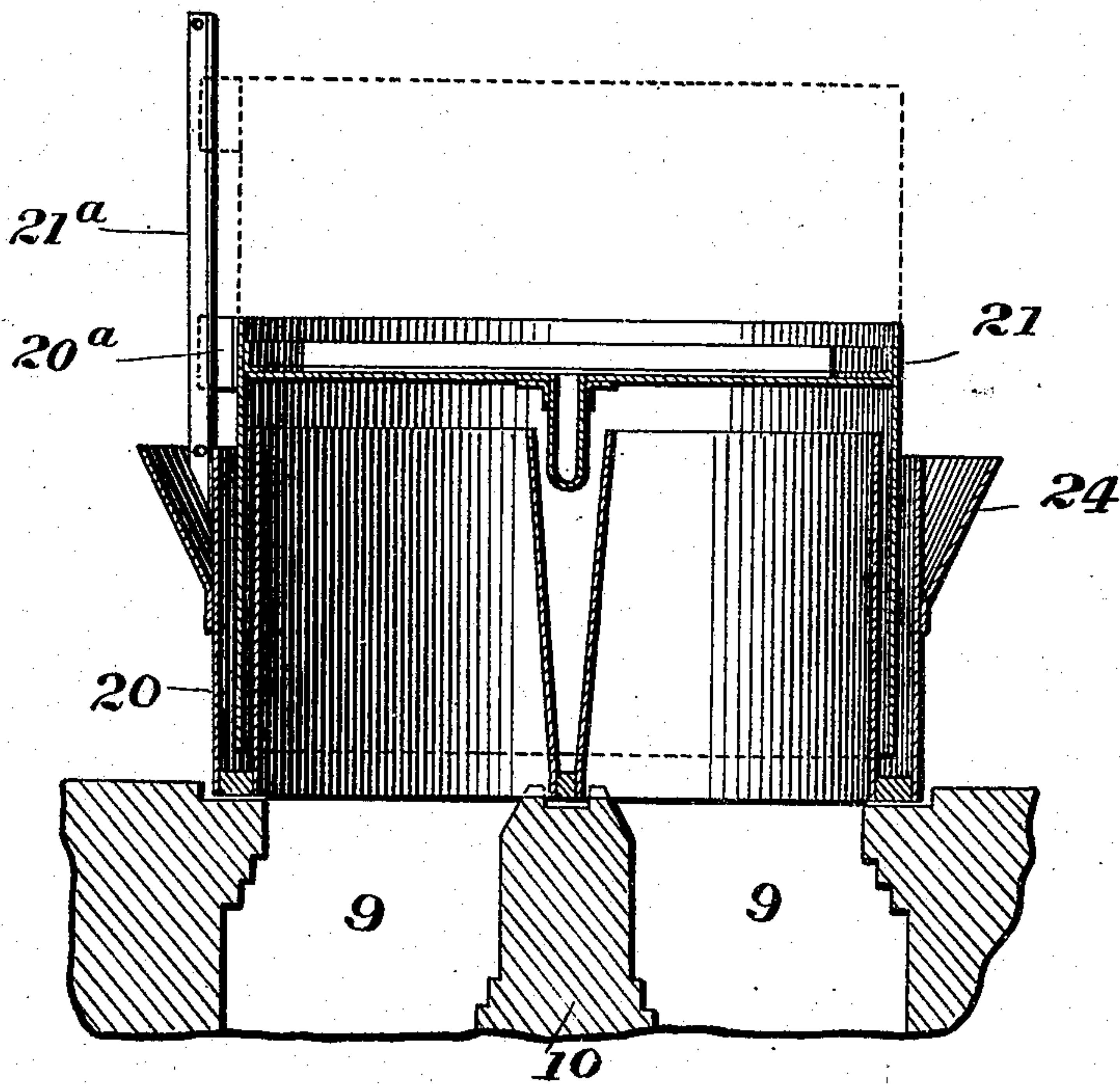


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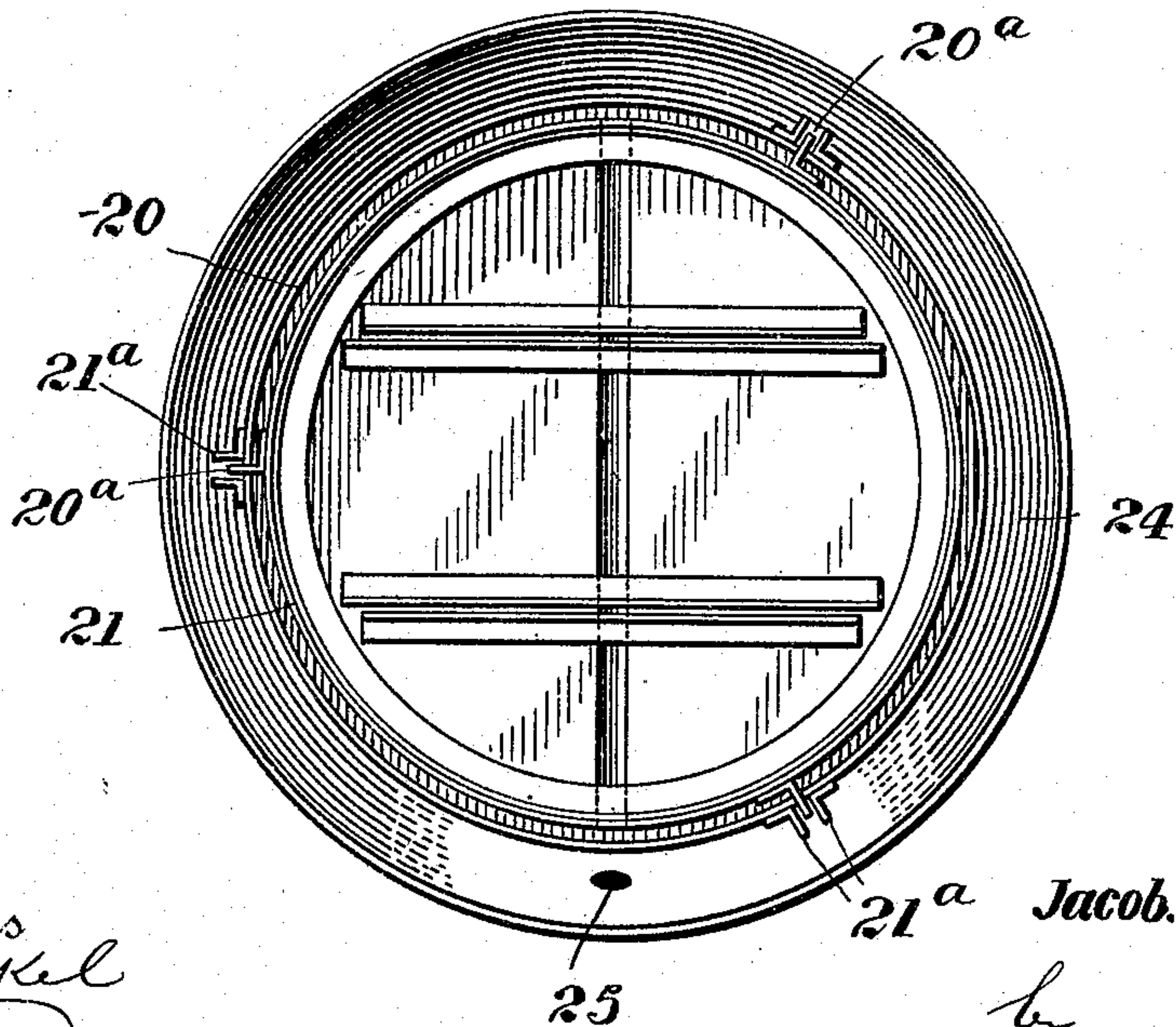
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 4 SHEETS—SHEET 3.

*Fig. 3.*



*Fig. 4.*



Witnesses  
*J. P. Hinkel*  
*E. P. Corbett*

Inventor  
*Jacob B. McKennan*  
 by *Engene C. Brown*  
 Attorney

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Fig. 5.

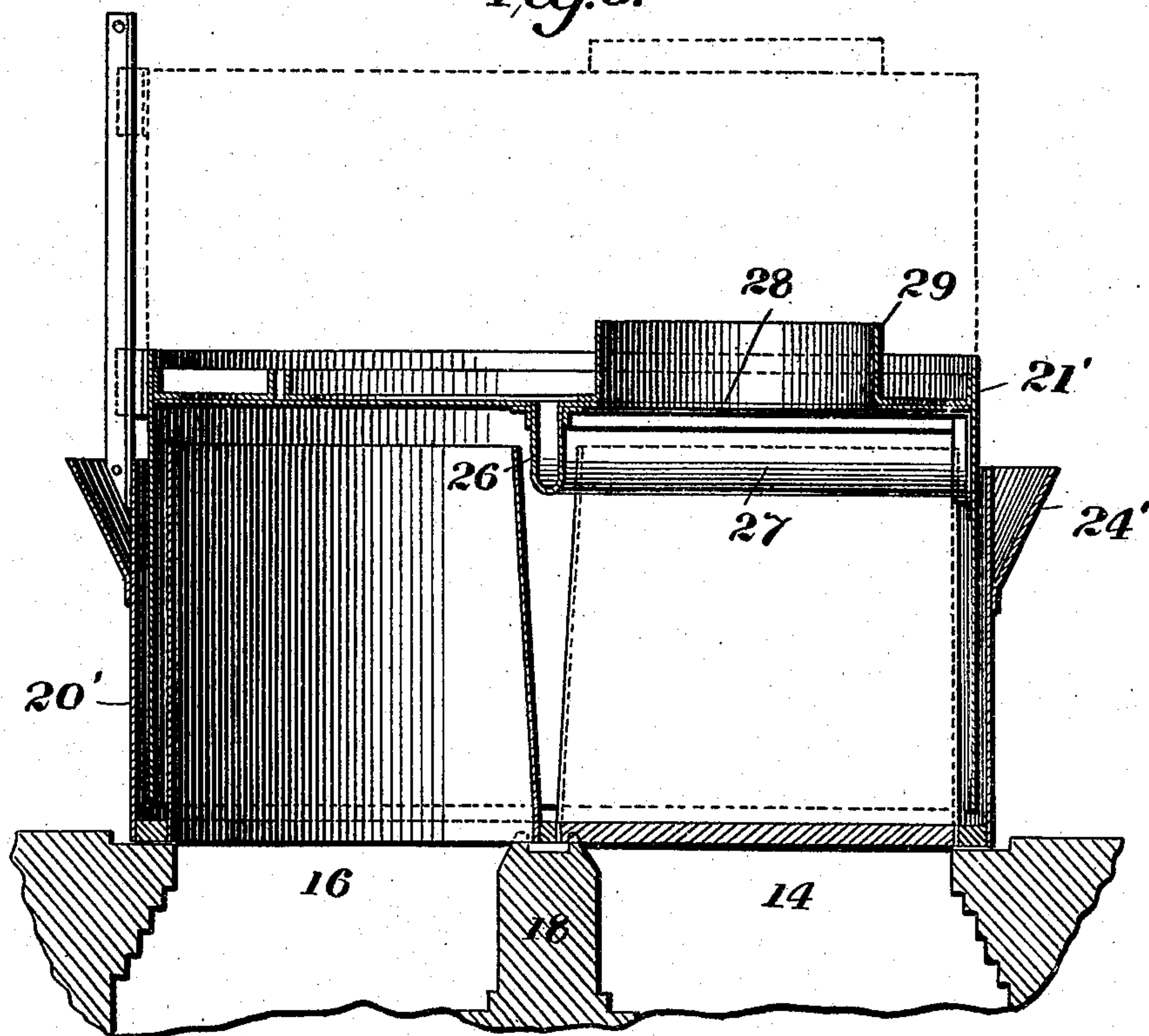
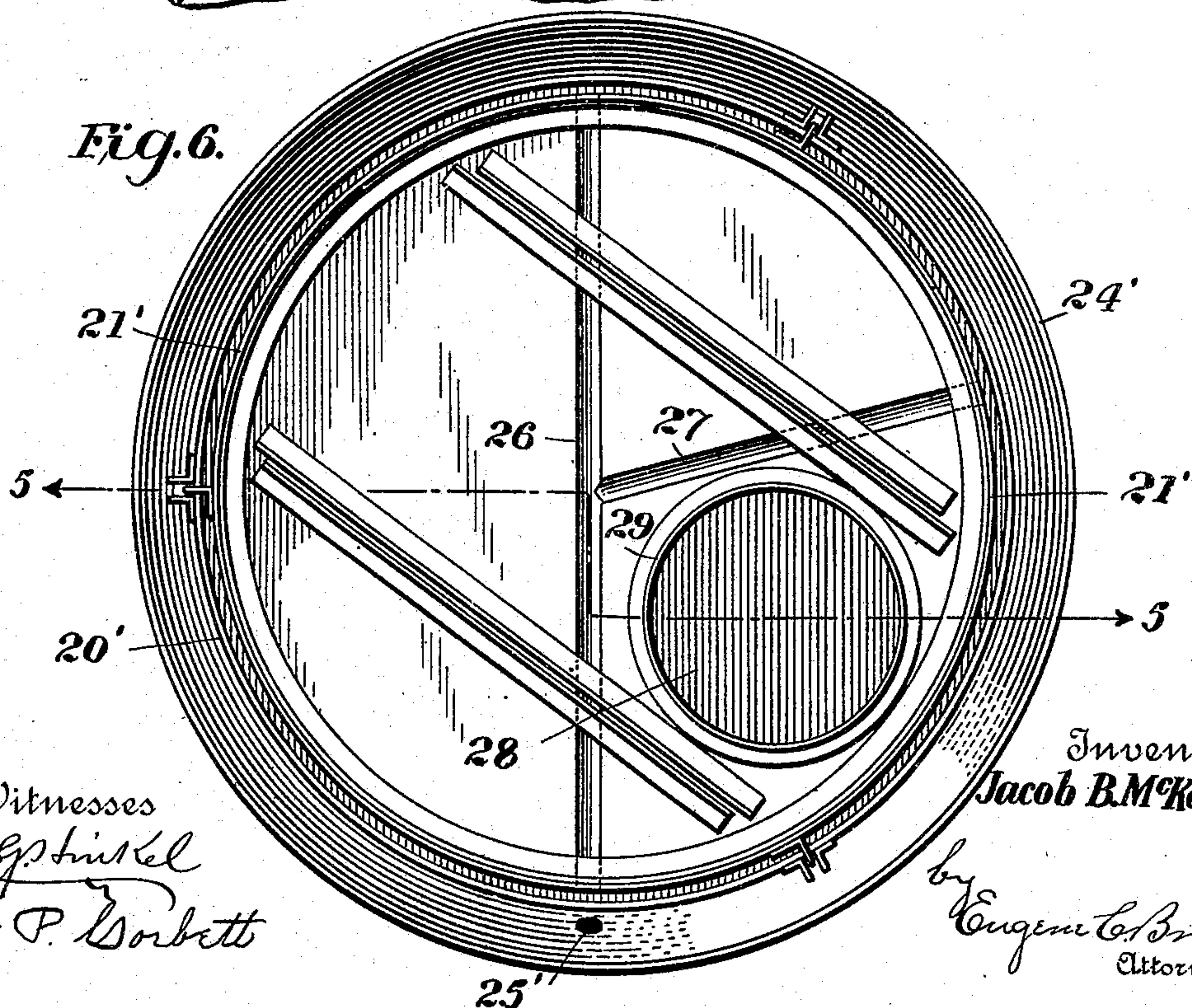


Fig. 6.



Witnesses  
*J. P. Hinkel*  
*E. P. Durbett*

Inventor  
**Jacob B. McKennan**

by *Eugene C. Brown*  
 Attorney



# UNITED STATES PATENT OFFICE.

JACOB BOWMAN McKENNAN, OF PUEBLO, COLORADO.

FLUE AND VALVE SYSTEM FOR REGENERATIVE FURNACES.

936,931.

Specification of Letters Patent.

Patented Oct. 12, 1909.

Application filed March 15, 1909. Serial No. 483,474.

*To all whom it may concern:*

Be it known that I, JACOB BOWMAN McKENNAN, a citizen of the United States, residing at Pueblo, in the county of Pueblo and State of Colorado, have invented certain new and useful Improvements in Flue and Valve Systems for Regenerative Furnaces, of which the following is a specification.

My invention relates to flue and valve systems for regenerative furnaces, of the general type shown in my Patent No. 881,328, granted March 10, 1908, and its object is to simplify the construction and operation of the supply- and stack-flues of such furnaces and of the valves governing such flues; without sacrificing any of the advantages of the system of the above-mentioned patent.

In order that my present improvements may be fully understood reference is made to the accompanying drawings, in which;—

Figure 1 is a plan, showing portions in horizontal section, and partially diagrammatic, of a furnace with its associated regenerators, supply main, flues and stack, with one embodiment of my invention applied thereto; Fig. 2 is an elevation of the valves and their associated mechanism, as located on the right side of Fig. 1; Fig. 3 is a vertical, diametral section of the gas-valve, its water-pan and vertical flue sections; Fig. 4 is a plan of the gas-valve and water-pan; Fig. 5 is a vertical diametral section, taken on the line 5—5 of Fig. 6, and similar to Fig. 3, of the duplex air- and draft-valve; and Fig. 6 is a plan of the parts shown in Fig. 5.

In regenerative open hearth furnace construction it is desirable not only to provide for the safe and ready reversal of the furnace; but also to secure a construction in which all the regenerators may be simultaneously sealed from the stack, to retain the heat over a temporary shut-down, or all simultaneously opened to stack, for cooling when repairs are necessary. It is also desirable that the same valves which open or seal the supply- and draft-flues may be used to regulate the supply or draft; so that separate regulating valves and dampers may be dispensed with. I attain all these objects by the construction hereinafter described; preferably by the use, with my novel flue system, of valves of the general type shown in my Patent No. 884,033, modified as will

hereinafter appear and as set forth in my copending application.

In the drawings, 1 represents diagrammatically the furnace hearth, 2 the gas-regenerators, 3 the air-regenerators, 4 the gas-main, and 5 the stack. These, with the air uptakes 6, and gas uptakes 7, may be of the usual, or any desired construction.

As shown at the lower right hand portion of Fig. 1, the gas-main is connected to the gas-valve uptakes by a short, depressed flue 8, and these uptakes, or vertical flue-sections 9, 9, are separated by a wall 10. The inner flue-section 9 is thence connected to the gas-regenerator by a flue 11, having a lateral return branch 12, which connects it to the draft system.

The air-regenerator is provided with a flue 13, which serves as both supply and draft flue. These flues 12, 13, open into sectoral portions 14, 15, of a vertical, circular chamber which may be controlled by the duplex air- and draft-valve hereinafter described. The passages 14 and 15, as well as the wider sector 16, form short vertical flues, or uptakes, separated by walls 17, 18, and are preferably capped by the water-pan structure of the duplex valve, described below, although these two passages might be independently controlled by separate valves. The vertical flue 16 is connected directly to the stack 5 by a depressed horizontal flue 19. It will be understood that the cross-sections of these flues and uptakes are preferably proportioned to the volumes of air, gas, or products of combustion to be conveyed by each; although such proportioning has not been clearly illustrated in the diagrammatic view.

The general arrangement of the simple gas-valve and the duplex valve is shown in elevation in Fig. 2, and arranged for the flue-sections 9, 9, and 14, 15, 16, on the right side of Fig. 1, the valves for the corresponding flue-sections upon the left side being reversely arranged. The casing 20 is double-walled to furnish a water seal for the valve, and is provided with an overflow trough 24 surrounding the upper portion, a drain or sewer connection 25 serving to keep the trough normally empty. Instead of forming the trough of a separate piece of metal as illustrated, it may be made integral with the casing, as, for instance, a single steel casting. The hood or lift-valve



depending into the water-seal of the casing, is supported by the rod 22, which is secured to the plunger 22<sup>a</sup> of a fluid pressure cylinder 23, connected to a suitable source of fluid pressure, by which the valve may be raised to any desired position. The valve may be guided by means of angle lugs 20<sup>a</sup> sliding between vertical guides 21<sup>a</sup>. The hood or valve should be made as thin as possible in order to secure the cooling effect of the air and to displace as small an amount of water as possible, being stiffened by means of a plurality of angle irons extending across the top. Water for cooling the top of the lift valve is retained thereon by means of a projecting marginal rim.

The structure of the duplex air- and draft-valve is similar to that of the gas-valve, just described, and its corresponding parts are designated by corresponding "primed" numerals. No further description of these parts is deemed necessary. This valve is of a diameter greater than that of the gas-valve, in proportion to the volume of fluids to be regulated thereby. It is provided with a diametral depending flange 26, adapted to seal both uptakes 14 and 15 from 16 when the valve is closed, and also with a radial depending flange 27 for similarly sealing 14 from 15 when it is closed; and the sectors capping the uptakes 15 are each provided with an orifice 28, having an upstanding rim or flange 29, of a depth preferably somewhat greater than that of the outer rim of the valve for the purpose of permitting the water which covers the top now overflowing into it. This orifice 28 constitutes the inlet for the air-regenerators, in one embodiment of my invention, and it is controlled by a practically stationary valve or lid 30, which may be constructed like two saucers or shallow vessels, united bottom to bottom; so as to permit water-cooling when closed, although such cooling is not necessary. Suitable supply and overflow connections (not shown), may be provided for this disk-valve. This disk is supported by suitable flexible connections 31, such as a wire cable, from an adjusting mechanism, shown in a general way at 32. Although I deem this arrangement preferable, for reasons hereinafter explained, it is obvious that the air might be admitted to the regenerators by a separate and independent valve as shown at 30' on the lower left-hand portion of Fig. 1.

The operation of the parts above described will now be understood. When it is desired to reverse the furnace, the operator simultaneously closes the gas valve 21 on one side of the furnace and the duplex draft valve 21' on the other side of the furnace; and then simultaneously opens the other gas and duplex draft-valve. Obviously all of the valves might be operated simultaneously instead of operating them in pairs. The raising of a

gas valve 21, not only admits gas from the main 4 to the regenerator 2 through the flues 8 and 11, but the amount it is raised determines the volume of the flow of gas. When the duplex valve 21' on the same side of the furnace is lowered, it seals both flues 12 and 13 from the stack and admits air to the flue 13 and regenerator 3 through the orifice 28, by reason of the fact that the disk valve 30 is held suspended by the rod or link 31. The amount of air admitted may be regulated by adjusting the height of the disk 30 above the orifice.

It will be readily understood that when the draft-valve (duplex valve) is opened to stack, the disk-valve is picked up by the hood of the larger valve and the air supply cut off from the regenerator on that side, and, having a flexible or link suspension, the disk-valve may rise with the duplex-valve as far as may be necessary to open the stack connections. In this position the rim of the disk-valve dips into the water on top of the hood and forms a water-seal around the orifice 28. In practice, therefore, it is not necessary to provide any opening mechanism, but merely an adjusting mechanism 32 for this disk-valve. The peripheral water-seal of the duplex valve is never broken because its deep depending hood-rim is never raised entirely out of the casing 20'. (See Fig. 5).

The overflow troughs 24, 24, are provided to maintain a practically constant level in the water-pans. When the valve-hoods are up, the sealing and cooling water overflows from the pans to these troughs which are kept practically empty by the screw connection. When the hoods are lowered, the displaced water overflows more rapidly into the troughs; so that the level in the pans never rises more than a fraction of an inch.

The advantages of my invention are that a single set of valves regulate the gas, air and draft flow as well as reverse the furnace; no dampers or special regulating valves being necessary. The valves are efficient. (water sealed), simple, cheap and operable by the simplest devices; and the construction of the duplex-valve is such that the operation of one valve (the air-inlet) requires no attention during the reversal.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a furnace, in combination, gas- and air-regenerators, supply and draft flues, a regulating valve for the gas-supply flue and a duplex valve one part of which controls the flues and the other part of which controls the regenerators, and both of said parts acting simultaneously to control the draft flues for both regenerators and the inlet for the air-regenerator.

2. In a furnace, in combination, gas- and air-regenerators, supply flues for each, regulating valves for said supply flues, converg-



ing flues connecting both regenerators to a stack, and a duplex valve opening the stack flues and controlling the flow of gases there-through, one part of said duplex valve being  
5 arranged to control the converging flues and the other part to control the stack flues.

3. In a furnace, in combination, a plurality of regenerators, supply inlets therefor, a regulating valve controlling one of said in-  
10 lets, adjacent draft-flues for said regenerators, and a duplex valve for simultaneously controlling both of said draft-flues and the other supply inlet, one part of said duplex valve controlling the draft flues and the  
15 other part the supply inlet.

4. In a furnace, in combination, a plurality of regenerators, supply- and draft-flues therefor, a single valve for admitting and controlling the supply to one regener-  
20 ator and a duplex valve for admitting and controlling the supply to the other regenerator and connecting and controlling the draft from both regenerators, one part of said duplex valve controlling the draft flues  
25 and the other part controlling the supply flue.

5. In a regenerative furnace, adjacent flues for the regenerators, an inlet for one of the regenerators having a simple controlling  
30 valve, a cross-flue terminating in proximity to the flue of the other regenerator, both the terminals adjoining a common stack-flue, and a duplex valve having portions for simultaneously connecting said terminals to stack  
35 and regulating the flow in said flues, and controlling the inlet of the last named regenerator.

6. In a regenerative furnace, in combination with the regenerators, adjacent flues  
40 therefor constituting supply and discharge

flues, an inlet branch for one of said flues, a water-sealed lift-valve for controlling said branch a deflected discharge branch for said flue terminating in proximity to the flue of  
the other regenerator and to the stack flue, : 5 and a duplex water-sealed lift-valve for connecting and controlling the draft from both regenerators and the inlet for the second regenerator.

7. In a regenerative furnace, in combina- 50 tion, a plurality of adjacent vertical flue-sections constituting supply, discharge and stack flue sections, and a duplex valve adapted, when raised, to connect two of said sections to each other and admit fluid to one of 55 said sections.

8. In a regenerative furnace, in combination, a plurality of adjacent, sectoral flue-sections, a sectoral duplex valve adapted to  
be raised and lowered for controlling said 60 sections and having a water-pan, means for preserving the water-level in said pan, an inlet in the hood of one of said valve sectors, and a flexibly supported sealing disk adapted to close said inlet when the valve is 65 raised.

9. In a regenerative furnace in combination with regenerators, a plurality of adjacent vertical flue-sections constituting re-  
spectively supply, discharge and stack flue- 70 sections for said regenerators and each section being adjacent to the two others and water-sealed lift-valves for connecting and controlling said flue-sections.

In testimony whereof I affix my signature, 75 in presence of two witnesses.

JACOB BOWMAN McKENNAN.

Witnesses:

JAS. H. ROBINSON,

A. L. BENZ.