

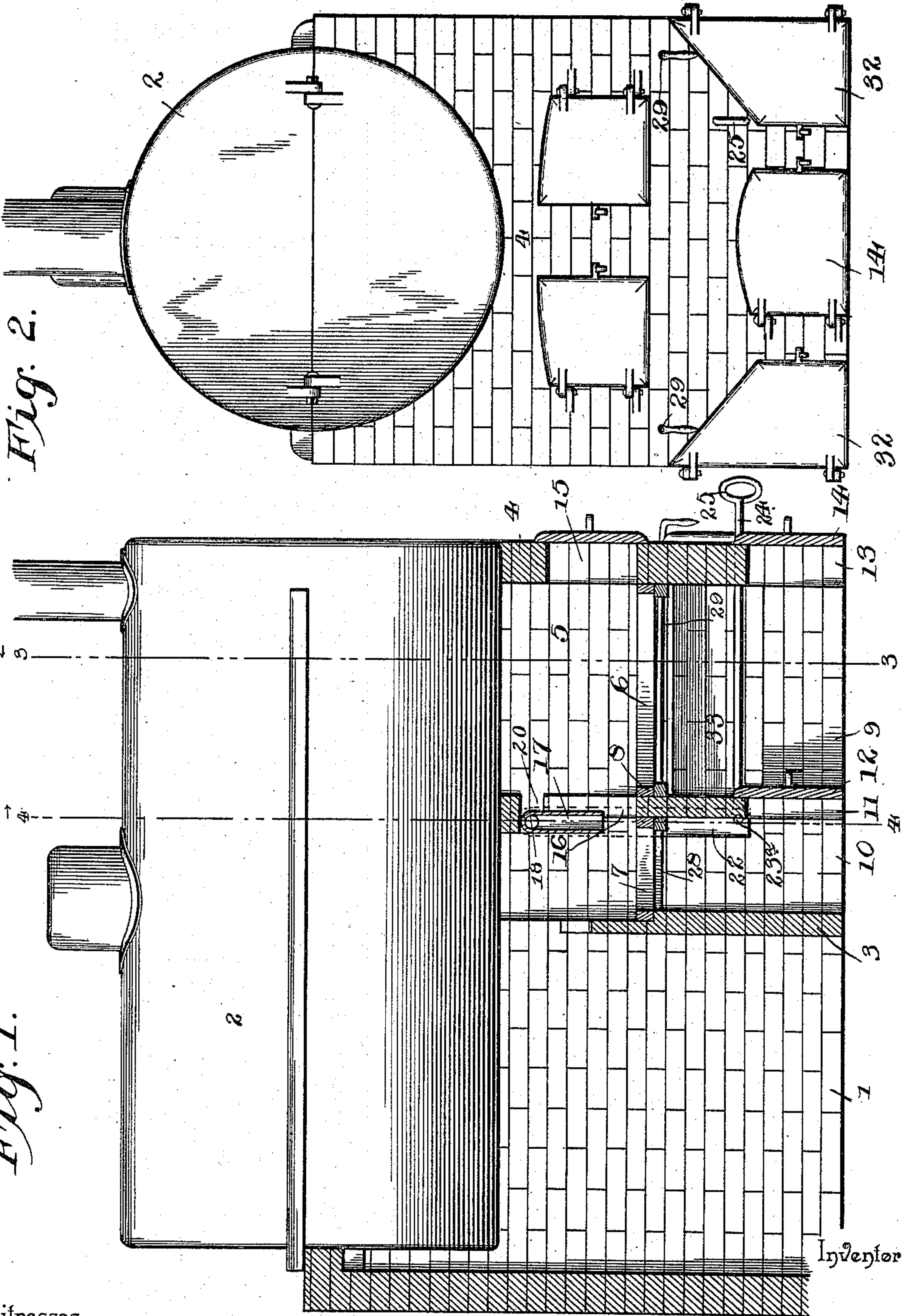
(No Model.)

3 Sheets—Sheet 1.

G. A. BELL.  
SMOKE CONSUMING FURNACE.

No. 573,385.

Patented Dec. 15, 1896.



Witnesses  
*Chas. A. Ford.*  
*S. P. McLaughlin.*

By his Attorneys, *George A. Bell,*  
*Chas. A. Bell,*



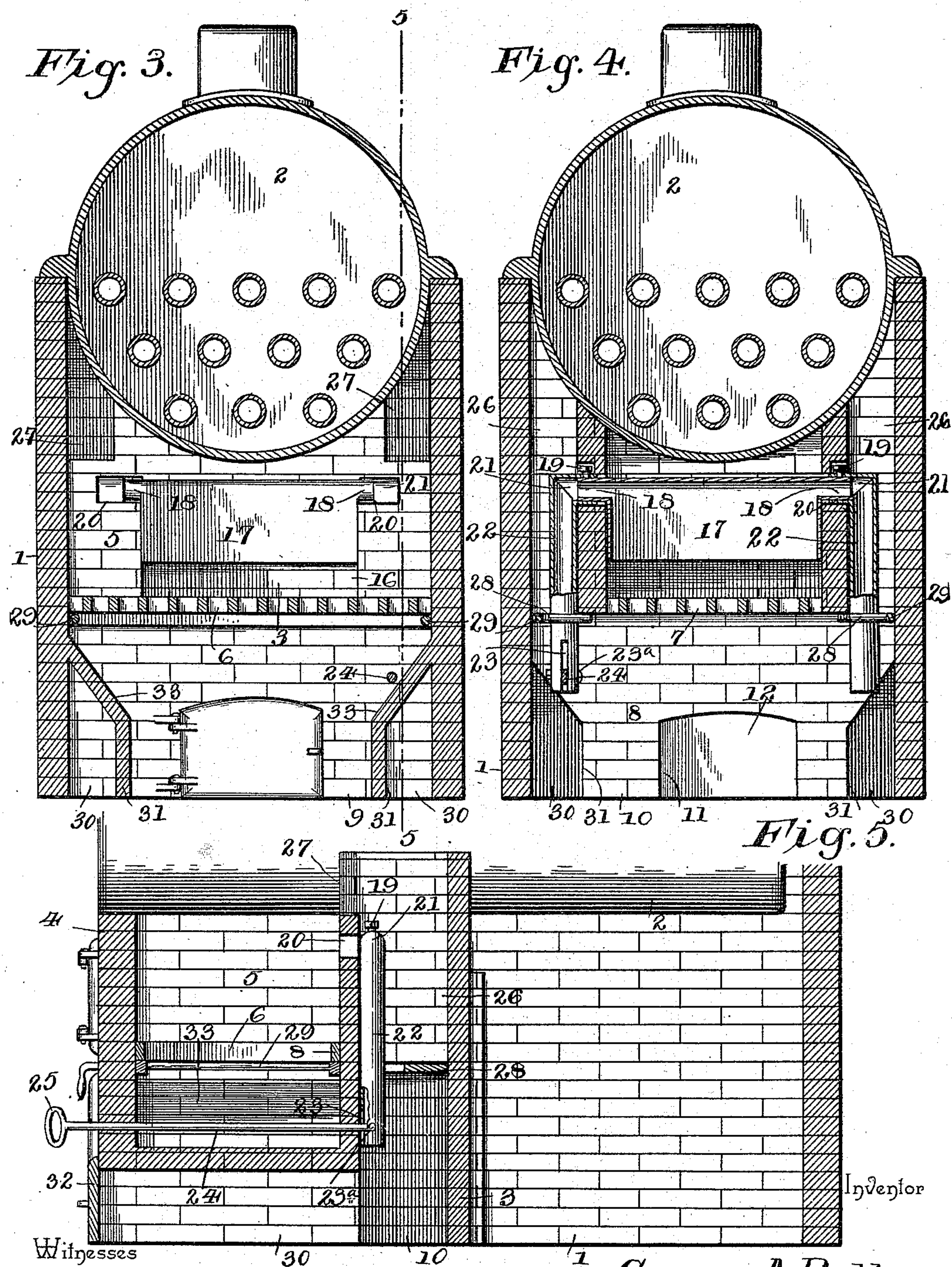
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3 Sheets—Sheet 2.

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Witnesses  
Chas. A. Ford.  
S. P. Whipple

By his Attorneys, George A. Bell,

CA Snow & Co

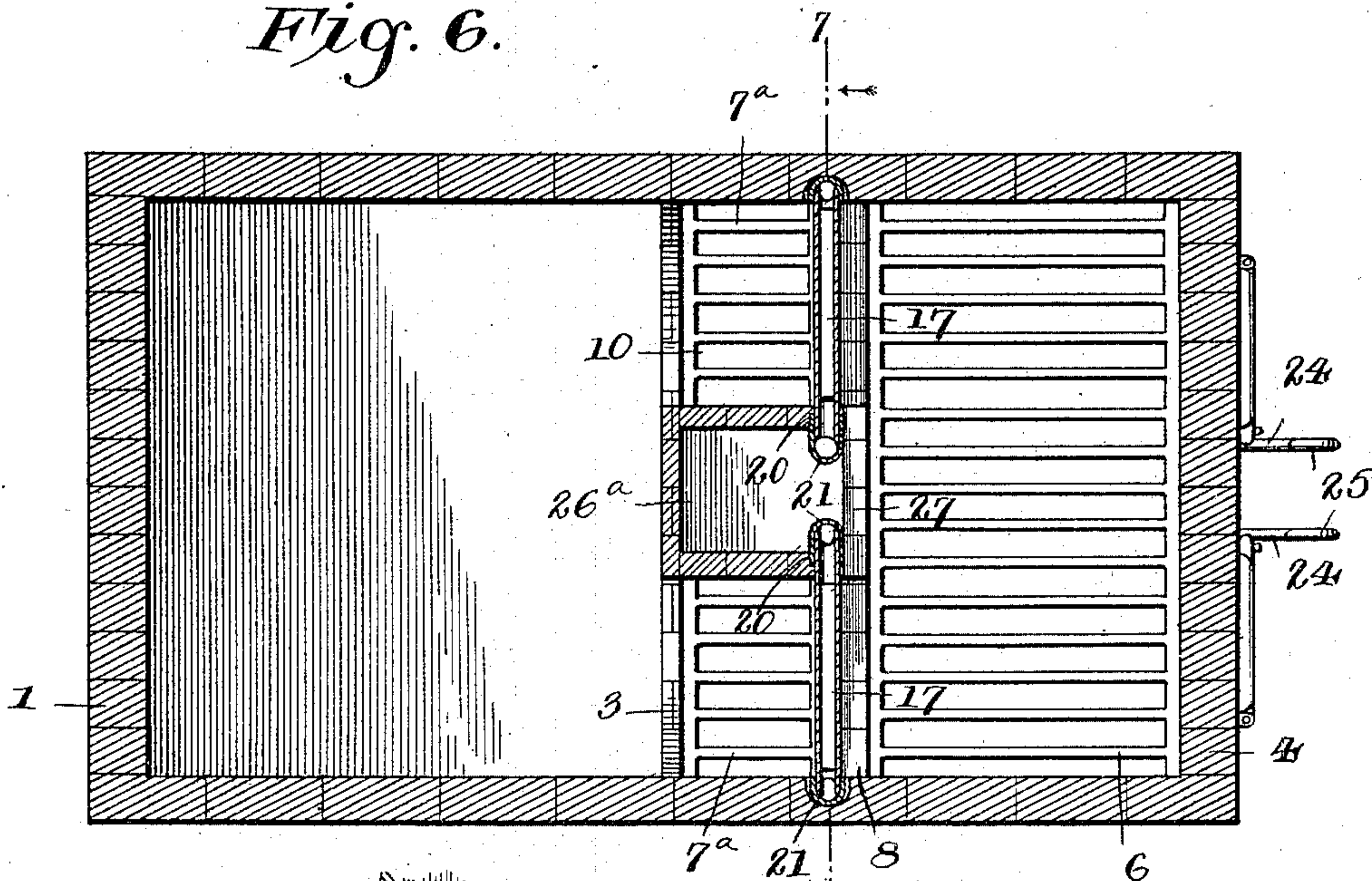


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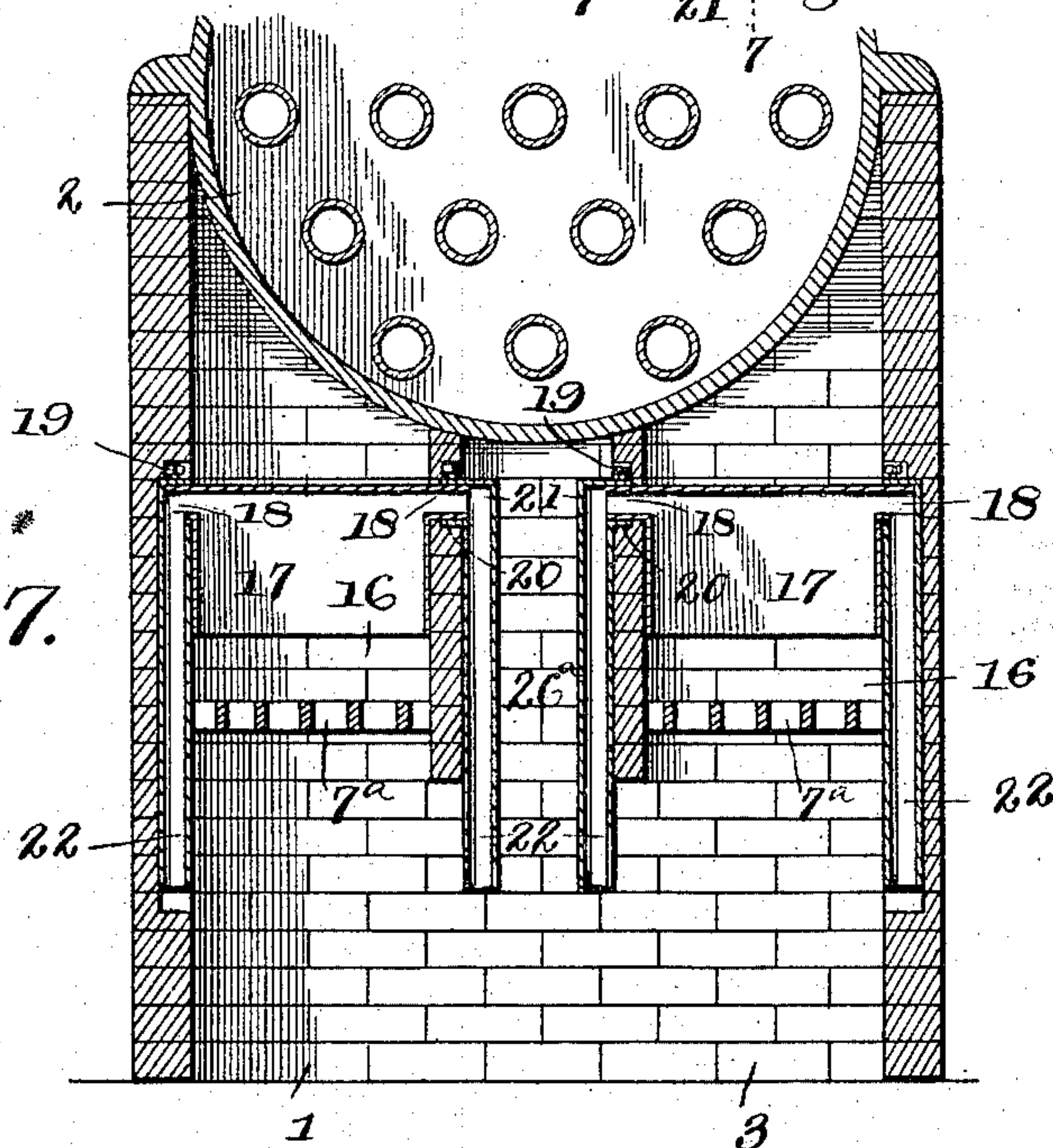
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*Fig. 6.*



*Fig. 7.*



Witnesses

*Chas. A. Ford.*  
*S. T. Holcomb.*

By his Attorneys.

Inventor  
*George A. Bell,*

*C. A. Snow & Co.*



# UNITED STATES PATENT OFFICE.

GEORGE A. BELL, OF SANDWICH, ILLINOIS, ASSIGNOR OF ONE-HALF TO  
CLARENCE E. SLYE, OF SAME PLACE.

## SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 573,385, dated December 15, 1896.

Application filed October 15, 1895. Serial No. 565,781. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE A. BELL, a citizen of the United States, residing at Sandwich, in the county of De Kalb and State of Illinois, have invented a new and useful Double-Draft Smoke-Consuming Furnace, of which the following is a specification.

This invention relates to double-draft smoke-consuming furnaces; and it has for its object to effect certain improvements in smoke-consuming furnaces whereby the smoke and other products of combustion will be entirely consumed, so that the fuel will be completely utilized and a great saving thereof necessarily effected. In the accomplishment of this result the invention contemplates an arrangement of parts not only adapted for use in connection with steam-boiler furnaces, but also in connection with stoves and other kinds of heaters to provide positive means for effecting a saving in fuel.

With these and other objects in view, which will readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the drawings, Figure 1 is a longitudinal sectional view of a steam-boiler furnace equipped with the herein-described improvements. Fig. 2 is a front view of the same. Fig. 3 is a vertical transverse sectional view on the line 3 3 of Fig. 1. Fig. 4 is a similar view on the line 4 4 of Fig. 1, looking in the direction indicated by the arrow. Fig. 5 is a longitudinal sectional view on the line 5 5 of Fig. 2. Fig. 6 is a horizontal sectional view of a modified arrangement of parts, the line of section being through the hollow trunnions of the hollow baffle-walls. Fig. 7 is a cross-sectional view on the line 7 7 of Fig. 6.

Referring to the accompanying drawings, 1 designates an ordinary steam-boiler furnace-casing supporting therein the boiler 2 and provided therein at an intermediate point with the usual transversely-arranged bridge-wall 3, over the top of which the heat and other products of combustion pass to the rear end of the boiler in the ordinary manner. Between the intermediate bridge-wall 3 and the front wall 4 of the furnace-casing is con-

fining the fire-box 5, in which fire-box are arranged the horizontal front and rear grates 6 and 7, respectively.

The front grate 6 is larger than the rear grate 7 and forms the main grate, on which the fuel is partially burned or coked, while the rear smaller grate 7, which is in the same horizontal plane as the grate 6, acts in the capacity of a coke-grate, which at all times supports a layer of incandescent combustible, which materially assists in the consumption of the smoke, as will be more fully explained. At the point of junction between the horizontally-alined front and rear grates 6 and 7 is arranged a transverse partition-wall 8, which is built above and below the line of grates and extends from the floor or bed of the furnace-casing to the under side of the boiler 2, supported therein.

The portion of the transverse partition-wall 8, which is located at an intermediate point between the bridge and front walls of the furnace-casing, that is disposed below the plane of the grates 6 and 7 divides the space below the grates into the separate front and rear ash-pits 9 and 10, respectively, the ash-pit 9 being located beneath the grate 6 to receive the ashes therefrom, and the ash-pit 10 being located beneath the grate 7 for a similar purpose. In order that ready access may be had to the ash-pit 10, the wall 8 near the grates is provided with a door-opening 11, covered and uncovered by the door 12, and which communicates with the front ash-pit 9. Access is had to the front ash-pit 9 through the front door or draft-opening 13, formed in the front wall 4 of the furnace-casing and covered and uncovered by an ordinary door 14, and the said front wall 4 of the casing is also provided, above the line of the grates, with the usual fire-box door-openings 15, through which green fuel is introduced onto the front grate 6 in the usual way.

The transverse partition-wall 8 is provided therein, above the plane of the grate 6 and 7, with the draft-openings 16, in which is arranged to work an adjustable hollow baffle-wall 17. The pendent hollow baffle-wall 17 is open at its lower edge, so as to provide means for discharging cold air directly into and over the fire therebelow, and at its upper opposite



ends the said pendent hollow baffle-wall 17 is provided with the offstanding hollow trunnions 18, which communicate with the interior of the walls 17 and removably rest in the bearing notches or openings 20, formed in the front face of the partition-wall 8 at opposite ends of the openings 16 therein. The hollow trunnions 18, which project from the opposite upper ends of the wall 17, have detachably secured thereon, by means of the set-screw 19 or other suitable means, the upper elbow ends 21 of the depending cold-air pipes 22, which serve as ducts for carrying cold air into the hollow baffle-wall 17. The depending cold-air pipes 22, which are connected at their upper ends to the upper trunnions of the hollow baffle-wall, are arranged inside of the opposite vertical draft-flues 26, built within the furnace-casing at opposite sides of the coke-grate 7 between the bridge and partition walls 3 and 8, and which draft-flues will be hereinafter more particularly referred to. One of said cold-air pipes 22 is provided in one side near its lower end with a longitudinally-disposed slot 23, in which is pivotally fitted, as at 23<sup>a</sup>, the inner end of the adjusting-rod 24, extended through the front wall of the furnace-casing and provided at its outer end with a handle 25, whereby the same can be conveniently grasped for manipulating and adjusting the baffle-wall 17.

It will be noted that the baffle-wall 17 is narrower in width than the vertical width of the opening 16, and therefore the open lower edge of the wall 17 is always disposed sufficiently far above the plane of the two grates to allow the smoke and other products of combustion to readily pass from the front portion of the fire-box directly over the coke fire supported on the rear coke-grate 7. At times it may be necessary to adjust the pendent hollow baffle-wall 17 rearwardly, but such adjustment is intended to be comparatively slight, so that the distance between the lower edge of said wall and the grate 7 will vary but slightly, and therefore the smoke from the fuel on the grate 6 will at all times be compelled to pass in very close proximity to the fire on the grate 7 as it passes under the lower edge of said baffle-wall. While the adjustment of the baffle-wall does not materially vary the distance between the lower edge thereof and the grate 7, said adjustment provides for uncovering a greater area of the draft-openings 16, so as to materially assist the draft in the furnace when necessary.

At any time should it become necessary to remove the baffle-wall 17 for any purpose, and especially in repairing the furnace, this removal may be effected by first disconnecting the cold-air pipes from the hollow trunnions of the wall and then moving the baffle-wall forwardly, so as to carry the hollow trunnions thereof out of the bearing notches or openings in which they rest, as will be clearly seen from Fig. 3 of the drawings.

The opposite vertical draft-flues 26 com-

municate at their lower ends with the rear ash-pit 10 under the grate 7 and are provided at their upper ends with the draft-openings 27, formed in the partition-wall 8 and communicating with the portion of the fire-box directly above the main fire-grate 6. At their lower ends the opposite vertical side-draft flues 26 are covered and uncovered by the adjustable damper-plates 28, mounted on the pivot-rods 29, extended through the front wall of the furnace-casing to provide means for conveniently manipulating the dampers 28 to control the draft of the flues 26 as the requirements of the furnace may demand.

Reference has already been made to the depending cold-air pipes 22 in connection with the draft-flues 26, in which flues the said pipes are arranged, and at this point it is to be noted that the said cold-air pipes extend a sufficient distance below the lower open ends of the flues 26 and below the plane of the grate 7 as to positively insure the entrance of only cold air into the lower ends of the said cold-air pipes, so that such cold air unaccompanied by smoke may be conducted directly through the pipes 22 into the wall 17 and from thence into or over the fire below said wall. By reason of carrying a supply of cold air through the pipes 22 and the wall 17 it will be understood that such cold air, being always circulated through the walls 17, positively prevents the same from burning out in a short time and also materially assists in the complete combustion of the gases and the smoke arising from the burning fuel.

At opposite inner sides of the furnace-casing within the front ash-pit 9 are built the opposite horizontal side cold-air flues 30. The front ends of the opposite side cold-air flues 30 extend into the front air-inlet openings 31, formed in the front wall 4 of the furnace-casing and covered and uncovered by the draft-regulating doors 32, which are arranged at opposite sides of the front ash-pit door-opening 13, as clearly illustrated in Fig. 2 of the drawings. The inner ends of the opposite side cold-air flues 30 open into the rear ash-pit 10, directly under the rear coke-grate 7, and the top walls 33 of the flues 30 are inwardly and downwardly inclined, so that the falling ashes from the grate 6 will not accumulate thereon, but will be directed onto the floor of the ash-pit 9, as will be clearly seen from Fig. 3 of the drawings.

In the operation of the furnace it will be understood that the fuel as it becomes coked or partially burned on the primary or front grate 6 is stoked back from time to time onto the rear coke-grate 7, so that such rear grate supports at all times an incandescent layer of fuel. It will therefore be seen that the combustion on the grate 7 is practically perfect, so that any smoke which is passed through or over the fire on the grate 7 will be entirely consumed. Ordinarily the front door or draft-opening 13 of the front ash-pit 9 is slightly uncovered, while the air-inlet open-



ings 31 of the flues 30 are uncovered to a greater extent. With this adjustment of the draft it will be observed that a sufficient draft is supplied through the opening 13 to maintain the fire on the grate 6, while the cold air admitted through both of the draft-flues 30 into the rear ash-pit 10 keeps the fire on the grate 7 burning very brightly. The smoke from the fuel on the grate 6 will pass to some extent under the baffle-wall 17, directly over the fire on the grate 7, and will be consumed, while the main portion of the smoke passes through the draft-openings 27 at the upper ends of the flues 26 and, descending such flues, commingles with the cold air in the ash-pit 10 and rises through the fire on the grate 7 and is entirely consumed by such fire, so that no smoke whatever will pass over the bridge-wall 3 to the rear end of the boiler. By entirely closing the flues 26 by means of the dampers 28 all of the smoke may be compelled to pass over the fire 7 and consumed in this manner, while, on the other hand, when the fuel is banked up sufficiently high on the grate 6 and the flues 26 entirely opened all of the smoke from the fire on the grate 6 will practically pass down the flues 26 and up through the bright fire on the coke-grate 7. Again, it will be noted that entirely irrespective of the other parts of the apparatus the side cold-air flues 30 may be used to supply cold air directly to the coke fire 7, so as to maintain the same sufficiently bright to provide for the complete consumption of the smoke as it passes thereover.

If it is desired to pass all of the smoke over the fire on the grate 7, it is simply necessary to close the door 14 for the front draft-opening 13, and then the cold air which passes into the rear ash-pit 10 from the side cold-air flues 30 will rise through the vertical flues 26 and pass through the draft-openings 27 at the upper ends of said flues into the portion of the fire-box over the grate 6. The cold air at this point commingles with the smoke of the fire on the grate 6 and supplies the necessary oxygen thereto to provide for its complete combustion as it passes over the fire on the grate 7, it being of course understood that a sufficient portion of the cold air passes up through the grate 7 to support the combustion of the fuel thereon.

In connection with very large boilers it is sometimes found necessary, in order to properly distribute the air entirely across the fire-bed, to provide a slightly-modified arrangement of parts, which modified arrangement is illustrated in Figs. 6 and 7 of the drawings. In these figures of the drawings it will be observed that instead of employing a pair of the flues 26 at opposite sides of the furnace-casing a single vertical draft-flue 26<sup>a</sup> is employed. This single draft-flue 26<sup>a</sup> corresponds in every particular to the flues 26, excepting that the same is built centrally between the opposite side walls of the casing, but communicating with the rear ash-pit 10 and with the

front part of the fire-box over the grate 6 in the same manner as the flues 26. By reason of disposing the flue 26<sup>a</sup> centrally between the opposite side walls of the casing and between the walls 3 and 8 it will be observed that a pair of rear coke-grates 7<sup>a</sup> is employed, such grates being located at opposite sides of the central vertical flue 26<sup>a</sup>, but maintaining the same relation to the grate 6 as the grate 7 does. In connection with the modified arrangement of the coke-grates a pair of the hollow baffle-walls 17 is necessarily used, there being one of said hollow baffle-walls employed in connection with each of the grates 7<sup>a</sup>. The hollow baffle-walls 17 are mounted in position at opposite sides of the flue 26<sup>a</sup> in the same manner as hereinbefore described; but it will be observed that the cold-air pipes connected with the inner ends of the hollow baffle-walls are disposed within the central flue 26<sup>a</sup>, while the cold-air pipes 22, connected with the outer ends of the hollow baffle-walls, are suitably arranged in the opposite sides of the casing, so as to extend downwardly to take in cold air from the rear ash-pit 10. The result of this arrangement is simply that an increased supply of cold air is conducted to the fire through the hollow baffle-walls, thereby providing for the more complete combustion of the gases and smoke arising from the fire, as will be readily understood by those skilled in the art.

Changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

What I claim is—

1. In a furnace, the combination with the fire-box; of separate front and rear horizontally-alined grates mounted within the fire-box, a pendent hollow baffle-wall provided with hollow trunnions resting in suitable supports, said baffle-wall being disposed at a point approximately between the two grates, and suitably-arranged cold-air pipes connected with the hollow trunnions of said baffle-wall, substantially as set forth.

2. In a furnace, the combination with the furnace-casing inclosing the usual fire-box; of separate horizontally-alined front and rear grates mounted within the fire-box, a transverse partition-wall extending above and below the grates at the junction thereof and provided above the plane of the grates with a draft-opening, a swinging adjustable baffle-wall mounted within the draft-opening in the partition-wall and of a less width than the vertical width of said draft-opening, opposite vertical draft-flues arranged at opposite sides of the rear grate and communicating at their lower ends with the rear ash-pit below such grate, said vertical draft-flues being provided at their upper ends with draft-openings communicating with the portion of the fire-box above the front grate, and opposite cold-air flues arranged at opposite inner sides of the



furnace-casing and leading from the front wall thereof to the rear ash-pit under the rear grate, substantially as described.

3. In a furnace, the combination with the  
5 fire-box, of separate front and rear horizontally-aligned grates mounted within the fire-box, a transverse partition-wall extending  
above and below the grates at the junction  
thereof and provided above the plane of the  
10 grates with a draft-opening, said partition-wall being further provided in its front face at opposite sides of the draft-opening with  
bearing-notches, a swinging adjustable baffle-  
wall having at its upper opposite ends trun-  
15 nions removably resting in said bearing-notches, and an adjusting device having a suitable detachable connection with one of the  
trunnions of the baffle-wall, substantially as  
set forth.

20 4. In a furnace, the combination with the fire-box; of separate front and rear horizontally-aligned grates mounted within the fire-box, a pendent hollow baffle-wall supported  
at a point approximately between the two  
25 grates with its lower edge disposed above the plane of the same, and means for circulating cold air through said hollow baffle-wall, substantially as set forth.

5. In a furnace, the combination with the fire-box; of separate front and rear horizontally-aligned grates mounted within the fire- 30  
box, a transverse partition-wall dividing the space below the grates into separate front and rear ash-pits, a cold-air flue leading from the  
front of the furnace and opening into the rear 35  
ash-pit in front of the rear grate, a pendent hollow baffle-wall provided at its upper opposite ends with hollow trunnions resting in  
suitable supports, said baffle-wall being disposed at a point approximately between the 40  
two grates and having its lower open edge disposed above the plane of the latter, and depending cold-air pipes connected at their upper  
ends with said hollow trunnions and having 45  
their lower ends projecting into the rear ash-pit below the rear grate, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

GEORGE A. BELL.

Witnesses:

JESSE A. NEWTON,  
V. R. DAVID.