

(No Model.)

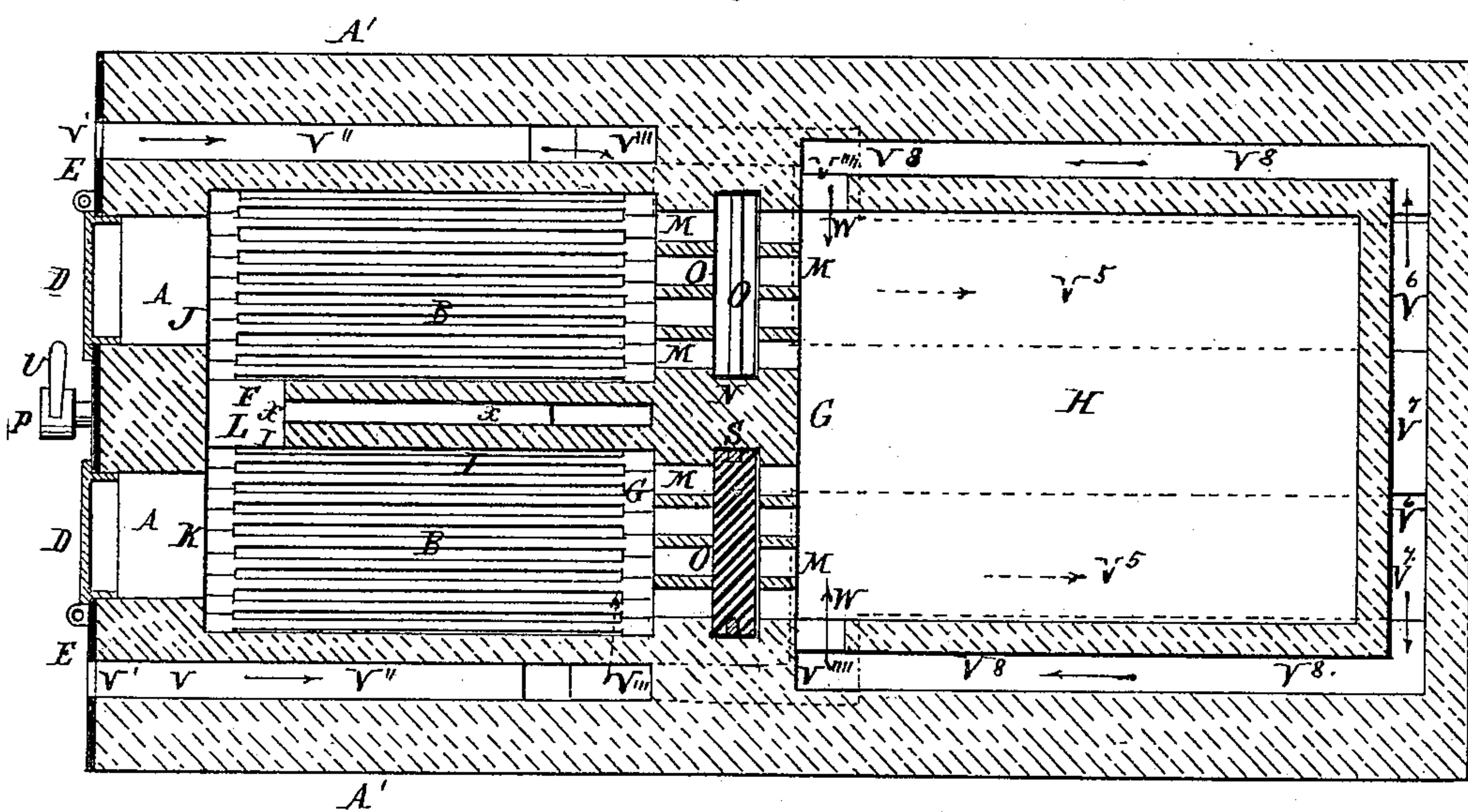
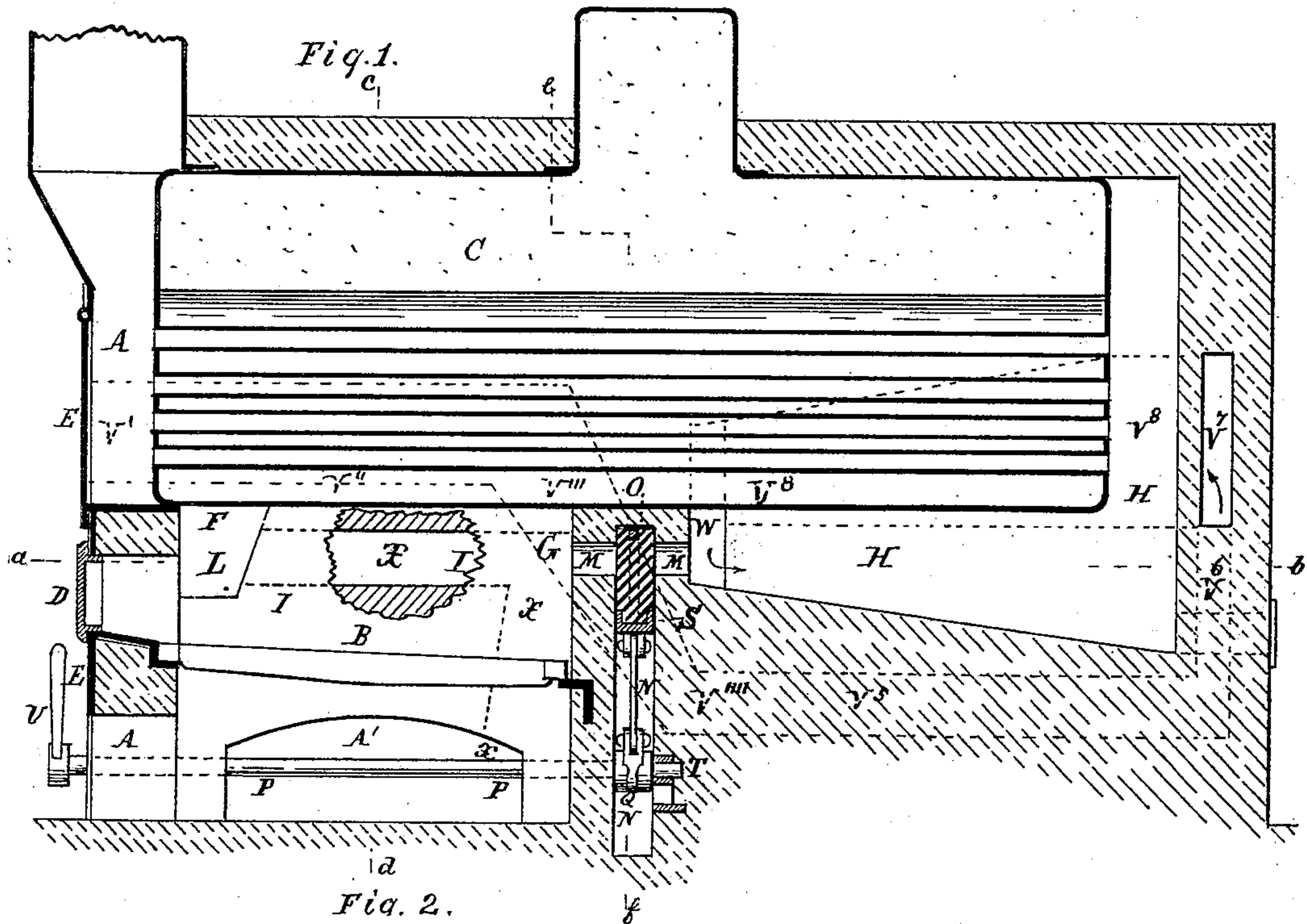
2 Sheets—Sheet 1.

J. GILBERT.

SMOKE CONSUMING FURNACE.

No. 397,353.

Patented Feb. 5, 1889.



Witnesses,
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Inventor.
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Fig. 3.

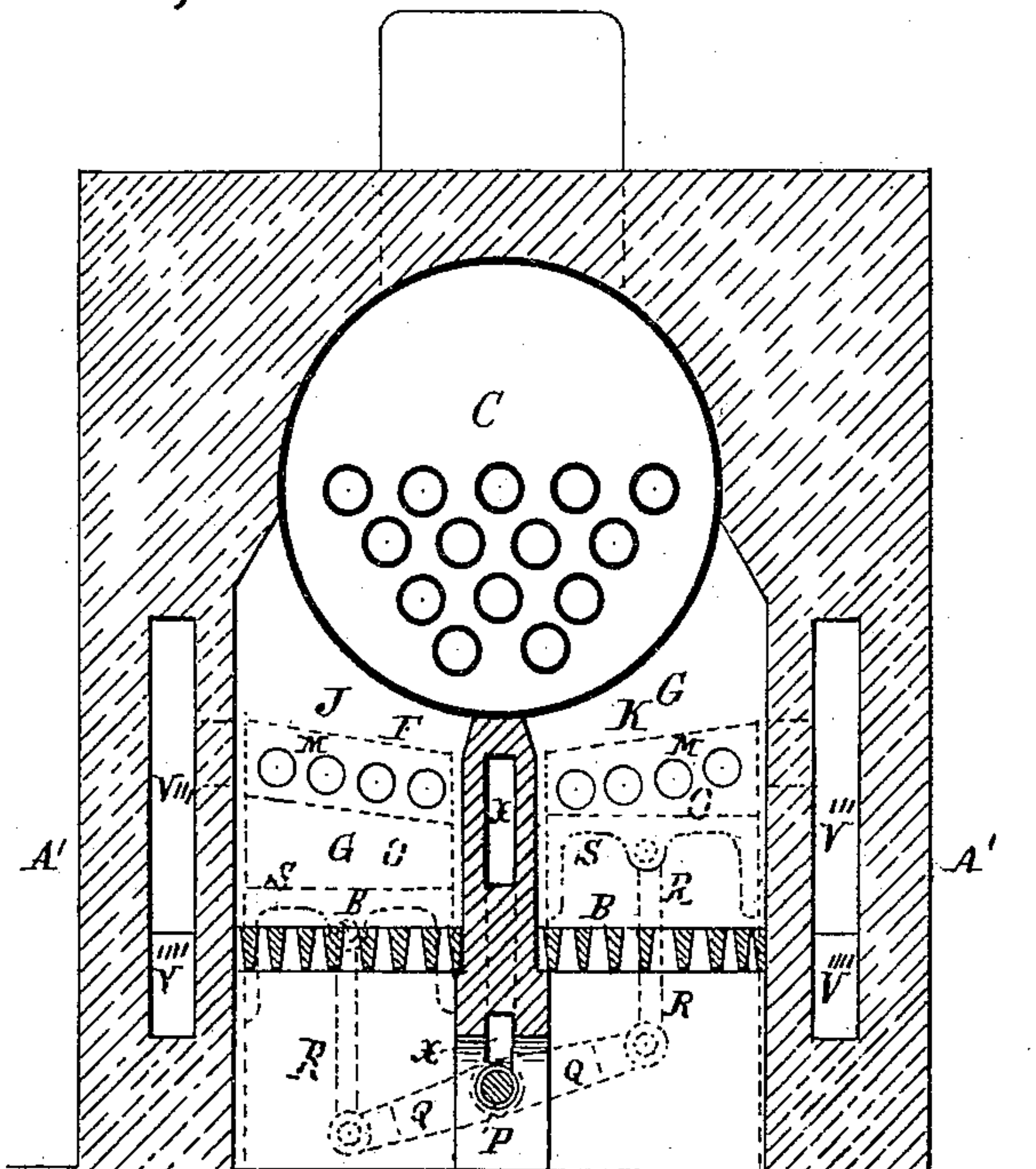
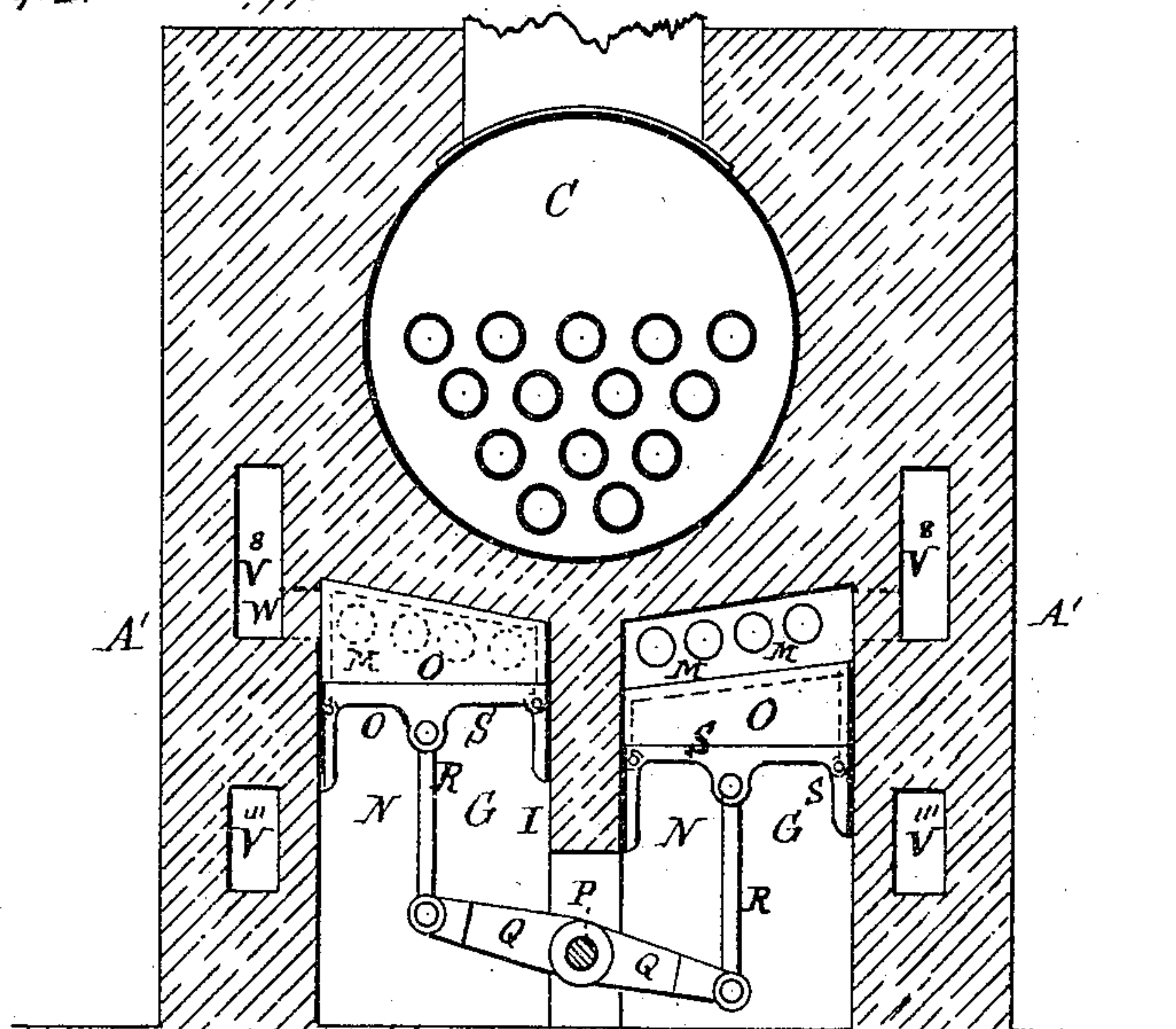


Fig. 4.



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JAMES GILBERT, OF OMAHA, NEBRASKA, ASSIGNOR OF ONE-HALF TO
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SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 397,353, dated February 5, 1889.

Application filed March 24, 1888. Serial No. 268,384. (No model.)

To all whom it may concern:

Be it known that I, JAMES GILBERT, a citizen of the United States, residing at the city of Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Smoke-Consuming Furnaces for Boilers and Analogous Purposes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to smoke-consuming furnaces for boilers; to a combination with a divided fire-chamber by a central longitudinal partition-wall and with said chambers and alternate-connected combustion-chamber, and passing the gases from the fresh-fed coal in one chamber over the bright fire in the secondary chamber; to an additional upward air-flue and a supply of heated air from the ash-pit to said fire and gases, and to additional air-flues heated in the side walls and delivering the same into the combustion-chamber for promoting combustion, consuming the smoke, and highly heating the furnace and obtaining superior economy.

In the annexed drawings, Figure 1 represents a vertical longitudinal central section of a smoke-consuming furnace applied to a horizontal boiler with a dividing bridge-wall from the boiler-bottom between the fire-box and combustion-chamber, all constructed and provided according to my invention. Fig. 2 is a horizontal section of the same, the section taken in a plane indicated by the line *a b* in Fig. 1. Fig. 3 is a vertical lateral section of the same, the section taken at the line *c d* in Fig. 1 through the fire-box of the furnace. Fig. 4 is a similar section taken at the line *e f* in Fig. 1 through the bridge-wall of the same.

The letter A of reference indicates the furnace front wall; A' A', the side walls; B, the grates; C, a horizontal tubular boiler; D, the fire-doors on the front plate, E, of the furnace. F represents its fire-box, G its bridge-wall, and H its combustion-chamber. By means of

a central vertical longitudinal partition-wall, I, from the front to the bridge-wall the common fire-box is divided longitudinally into two fire-box compartments, J and K, the ash-pits of which are connected by an arch-opening through the base of the wall I in the ash-pit space, so that each said compartments have each a separate fire-door, D, and an opening in the front wall to feed the coal, and each has a separate grate, B, and the spaces of both compartments above the grate connect by means of an opening, L, in said wall I at its junction with the front wall, A, and said wall I is built with a flue-passage, X, in it, conducting the air from the rear portion of the ash-pit up into the said wall, then forward, and discharging into the opening L, as shown. Both the bridge and partition-wall I join with the bottom of the boiler. The fire-box compartments and the combustion-chamber are divided by the bridge-wall, and their connection is cut off, except through a certain number of longitudinal flues or ports, M, made through said bridge-wall for each compartment of the fire-box, as shown, and in said bridge-wall for said ports M of each compartment is made a vertical, lateral, and nearly central space, N, in which for each is employed a vertical sliding tile-damper, O, by means of which said ports of either compartment are readily closed and its connection with the combustion-chamber shut off. The lower portions of the spaces N are connected, and a central longitudinal rock-shaft, P, is employed, with a balance or two-armed lever, Q, which has a central hub secured firmly upon said shaft, the arms of which project into the relative opposite spaces N, and each is connected with a damper, O, of the relative space by means of a connecting link or rod, R, to which said arm is pivoted. Said dampers may be constructed of metal, but are preferred of a clay tile secured in a frame, S, of metal having a pair of downward eyelids between which said rod R is pivoted. Said damper and frame are made flat and are guided by vertical metal ways to raise and lower or slide very readily either up to close said ports or down to open them. The inner end of said rock-shaft is guided in a metal bearing, T.

The outer end passes through the front wall, and is guided in the front plate, E, and upon its outer extreme end is secured firmly a hand-lever, U, for operating the same. Each side wall, A', of the furnace is built with a longitudinal and vertical air-flue, V, for conducting an additional supply of heated air for combustion of the gases into the combustion-chamber. Said air-flues have their entrance V' for the air at the front of each side wall, as shown. From the entrance V' each flue passes a portion, V'', horizontally into a second portion, V''', descending to a lateral flue, V''', beyond the bridge-wall and below the bottom of the combustion-chamber, and from there the air is conducted through a longitudinal portion, V⁵, into a vertical portion, V⁶, in the back wall, meeting in a common lateral horizontal portion, V⁷, of both flues of the side walls in said back wall. From said portion V⁷ the air is conducted through a meeting horizontal portion, V⁸, in each side wall forward until meeting the outlet-flue opening W from said portion V⁸, into the portion of the combustion-chamber close to the rear side of the bridge-wall, so that said air is highly heated, and in that state meets and supplies the products of combustion and gases from the fire-box at the rear of the bridge-wall in the combustion-chamber, whereby a highly-complete combustion of all smoke and combustible gases takes place in said combustion-chamber and the final products of combustion pass through the tubes of the boiler and the resultant heat passes into the water.

The furnace is operated alternately, feeding each fire-box compartment, so that while the fire in one box is bright and its damper placed down and its ports left open to communicate with the combustion-chamber the other box is supplied with coal, its damper is raised, and its ports shut off, as shown in Figs. 2 and 3. The fresh coal in this latter fire-box compartment is allowed to distill, and the resultant products pass from the first fire-box compartment into the secondary fire-box by means of the opening L in their wall I between; and while said products and gases pass through the opening L a supply of heated air is added through the flue X, and all said products pass for combustion over the bright fire, and the resulting products pass into the open ports M, and through them into the combustion-chamber, meeting the additional supply of air from the flue-openings W. Thereby the final combustion takes place, as before mentioned. After the coal in said fire-box compartment last supplied has become bright, said dampers are reversed, and the ports M in the compartment shut off are now opened, as shown in Fig. 4, and the operation of the fire is reversed. By the foregoing it will be observed that the resultant gases from the fresh coal receive an additional supply of air at the opening L, and in passing over the bright fire of the following fire-box are highly

heated, and the greater portion of the gases are brought to a state of combustion. Those not sufficiently supplied with oxygen for combustion are thereafter supplied in the combustion-chamber, where a final combustion takes place, and the resultant very high heat and the consumption of all smoke and combustible gases is obtained.

For more ready conception, I have shown in the drawings the entrance of the air-flues V in the side walls, A', as entering at a portion of said walls considerably above the grates of the furnace; but in practically constructing the furnace I arrange said entrances V' in said walls at a portion lower than the flue portions V⁴, to provide for the natural draft-current of air when being heated to pass either horizontally or upward and never downward.

I am aware that alternate-operating dampers have been used; but they have not been used in combination with air-supply flues additional to the supply of air through the grates and entering at a portion lower than the fuel-chamber or grates and delivering air to the products of combustion in the fire-box and also in the combustion-chamber or space beyond the bridge-wall without requiring a powerful draft or artificial blast.

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

1. In a smoke-consuming furnace, the combination, with connected fuel-chambers by an opening in the partition-wall between them and an alternate connected combustion-chamber with said fuel-chamber for passing the hot gases from the fresh-supplied fuel-chamber over the bright fire of the other fuel-chamber, of an upward air-flue, X, from a portion below the grates supplying additional oxygen to said hot gases while passing the bright fire, and also providing air-flues V in the side walls of the furnace delivering air by natural draft at the rear of the bridge-wall for furnishing heated air into the combustion-chamber to said gases, substantially for promoting combustion and the heat of the furnace, as herein set forth.

2. In a smoke-consuming furnace, the combination, with its combustion-chamber H and alternate connected and supplied fuel-chambers, of the hot-air flue X for the fuel-chambers supplied independent from a portion of the furnace below its grates, and the air-flues V in the furnace-walls, supplied, as set forth, and delivering beyond the bridge-wall into the combustion-chamber H, and the dampers O, arranged to slide between the front and rear of the double-walled bridge-wall, all combined and within the walls of the furnace.

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

JAMES GILBERT.

Witnesses:

F. D. MUIR,

O. S. ROBINSON.