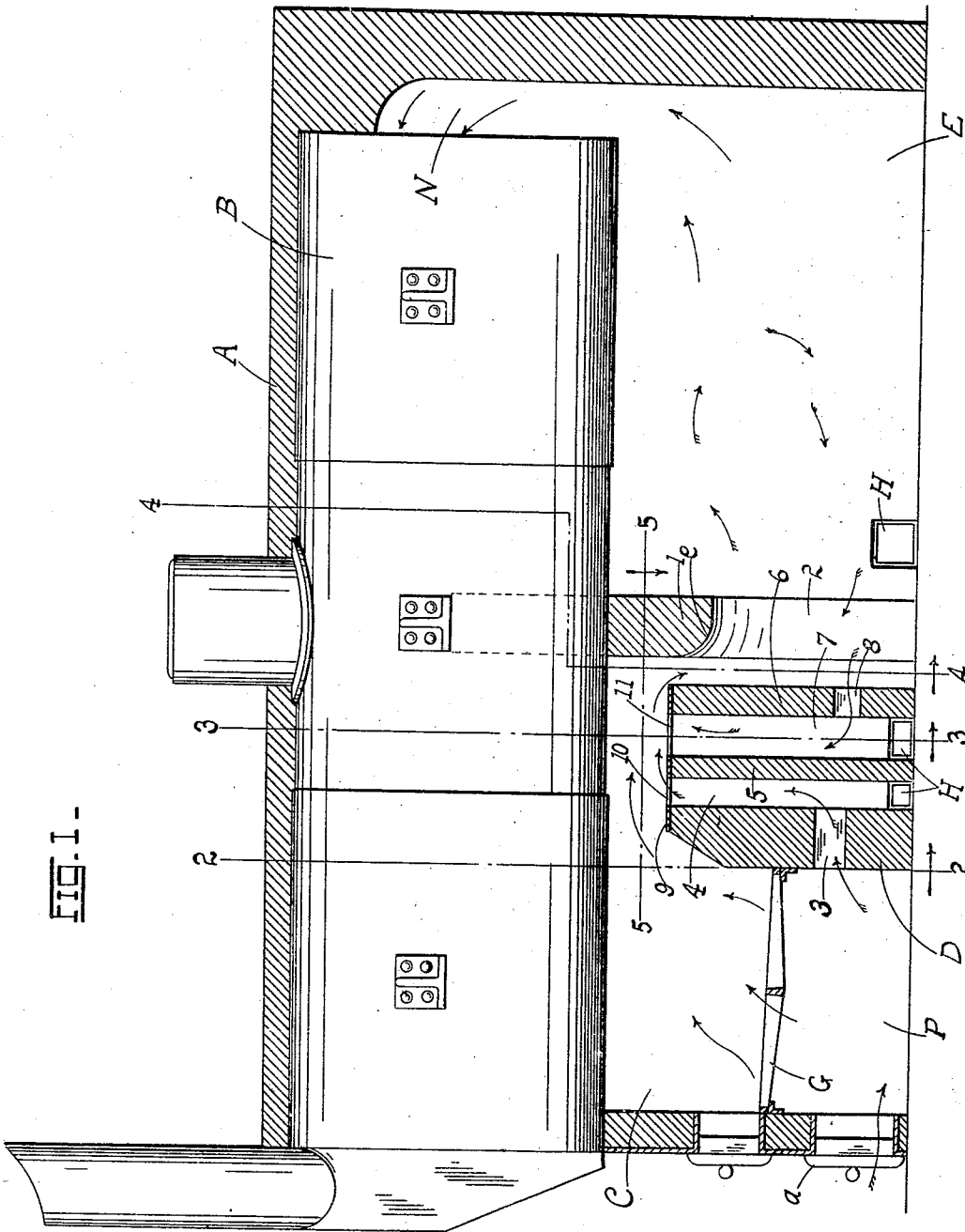


1,049,079.

Patented Dec. 31, 1912.

2 SHEETS—SHEET 1.

FIG. 1—



WITNESSES:

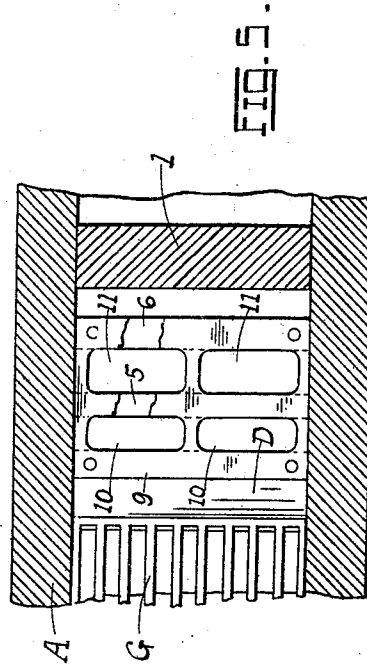
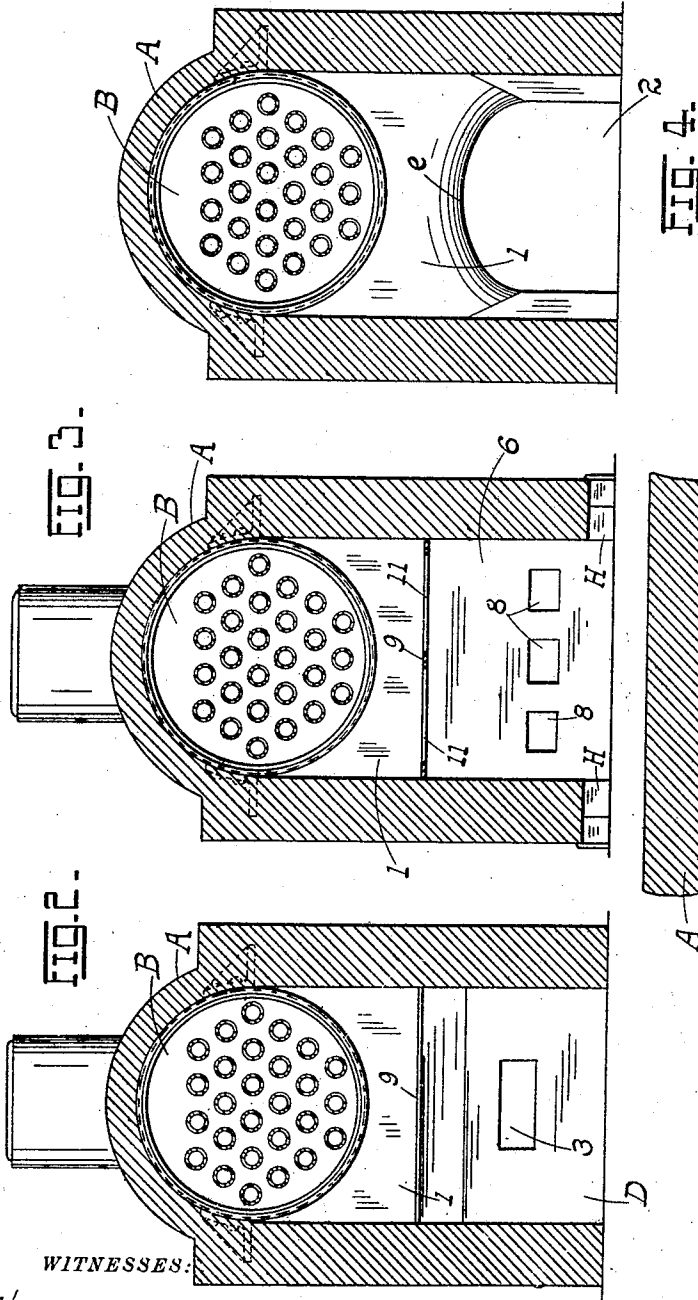
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SMOKE CONSUMING FURNACE
APPLICATION FILED MAR. 11, 1912.

1,049,079.

Patented Dec. 31, 1912.
2 SHEETS-SHEET 2.



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SMOKE-CONSUMING FURNACE.

1,049,079.

Specification of Letters Patent.

Patented Dec. 31, 1912.

Application filed March 11, 1912. Serial No. 682,982.

To all whom it may concern:

Be it known that we, JAMES G. GRACEY and EDWARD E. SQUIER, citizens of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

Our invention has relation to improvements in smoke consuming furnaces; and it consists in the novel features of construction more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a combined vertical middle longitudinal section of the furnace and side elevation of the boiler; Fig. 2 is a vertical transverse section on the line 2—2 of Fig. 1; Fig. 3 is a vertical transverse section on the line 3—3 of Fig. 1; Fig. 4 is a vertical transverse section on the zig-zag line 4—4 of Fig. 1; and Fig. 5 is a horizontal section on the line 5—5 of Fig. 1.

The present invention though eminently adapted to be used in connection with boiler furnaces, is not necessarily restricted thereto in its application, a boiler or steam generator being however, herein selected to illustrate one mode of applying the invention.

The object of the invention is to provide a furnace employing any character of fuel wherein every available combustible element of such fuel shall be consumed, so that smoke shall be entirely eliminated and perfect combustion assured.

Broadly speaking the invention contemplates a return of a part of the combustion products (only partially consumed) from the rear combustion chamber or the chamber beyond the bridge wall, back to a point in the region of a zone of complete combustion contiguous to the bridge wall, said zone being created by the accession of fresh air to the products escaping from the fire-box over the bridge-wall and passing under the boiler shell. The confluence of the two currents results in so thorough an intermingling of the returned products with the highly heated gases and air flowing from over the bridge-wall, as to completely consume every vestige of material not previously thoroughly oxidized.

In detail the invention may be described

as follows: Referring to the drawings, A represents a furnace, B a conventional cylinder flue-boiler, C the fire-box, D the bridge-wall, G the grate, and E the rear or secondary combustion chamber, and P the ash pit, all as fully understood in the art. Disposed rearwardly of the bridge-wall, and at a convenient distance therefrom at the front end of the combustion chamber E, is a partition or division wall 1 partially surrounding the boiler shell B, said wall having formed therein an arched opening or passage 2 preferably extending to the furnace floor at the bottom, and a short distance from the shell at the crown of the arch defining the opening. The front edge or corner *e* of the opening at the arch is preferably rounded so that the gases may better dip into the opening past said corner. Formed in the bridge-wall opposite the ash-pit P (the door *a* of which should be left open to freely admit atmospheric air under the grate) is an air induction opening or passage 3, the air drafted through said opening being discharged into a compartment or air-flue 4 between the bridge-wall and a transverse wall 5 spaced a suitable distance from the bridge-wall as shown. Between the wall or partition 5 and the division wall 1 is a second transverse wall 6 spaced a suitable distance from both the wall 5 and wall 1, and occupying a substantially central position between them. There is thus formed a compartment or gas flue 7 between the walls 5 and 6, said compartments 4 and 7 being contiguous to one another and separated by the wall 5. Communication between the compartment 7 and combustion chamber E is established through the large opening 2 in the wall 1, and a series of openings or passages 8 formed in the wall 6, the precise elevation or distance of the passages 8 above the floor of the furnace being best determined for each furnace, but they should be low enough so as not to interfere with the gases deflected, or dipping down from the corner *e*, and yet high enough to serve their purpose in directing a portion of the products from the chamber E into the compartment 7 for a purpose presently to appear. Preferably, the walls D, 5 and 6, which are of the same height, are surmounted by a plate 9 having openings or passage-ways 10, 11, opposite

the compartments 4 and 7 respectively, to allow for a free outlet of the gases from said compartments into the space between said plate and the boiler shell.

5 The operation of the furnace is substantially as follows:—The combustion products pass from the fire-box rearwardly over the bridge-wall D as usual, but in the present instance they receive an accession of fresh
10 air drafted from the ash-pit P through the opening 3 into the compartment 4, the latter discharging the air at the top of said compartment (through the openings 10 where a plate such as 9 is employed). The air cur-
15 rents thus induced through the opening 3 into the compartment 4 supply an excess of oxygen or more than is necessary to oxidize the unconsumed products leaving the fire-box, the mixed gases traveling rearward as shown by the arrows, where they encounter
20 the corner *c* of the arch of the opening 2 in the wall 1, dipping down from said corner and traveling rearward to the back flue N. Now, the current of air in the compartment
25 4 is in an upward direction, and in such upward flow and as it discharges from the mouth of the compartment 4 it induces an upward current in the compartment 7. This current is supplied by the gases from the
30 chamber E, a portion of which (in response to the induction created in the compartment 7) are drawn forward through the opening 2, and through the openings 8, flowing upward in the compartment 7 and mingling
35 with the mingled gases escaping from the fire-box C and compartment 4 respectively. These gases as previously stated contain an excess of oxygen, such excess being thus available in burning any and all unconsumed
40 products contained in the currents traversing the compartment 7. The compartments 4 and 7 are virtually flues, the former being traversed by atmospheric air and the latter by gases containing imperfectly consumed
45 products of combustion returned thereto from the combustion chamber E. The top or arch of the opening 2 of the wall 1 is lowered below the plane of the tops of the walls D, 5, 6, so as to cause the gases to dip;
50 otherwise they would have a tendency to rush toward the rear flue N, and the operation here described would in a measure be interfered with. Of course, some of the products will constantly flow back toward
55 the flue N following as they must, the general direction of the draft, but it will always be the lightest gases or those not charged with the slower moving smoke particles or partly consumed material. The latter on
60 the other hand will return toward the openings 8 in the wall 6 and flow into the flue 7 in response to the inducing action of the gases passing between the top of the walls 5, 6, and the boiler, and then (escaping
65 through the openings 11) mingle with the

general current which is charged with an excess of oxygen as already described. The result is that very little or no smoke is formed, the furnace being practically a perfect smoke consumer.

The construction here shown may be employed in stoves, ranges, and the like, and in lieu of fire-brick, cast iron may be employed in forming the various partitions and walls which give rise to the several flues.

The wall 1 as such is not absolutely necessary, the effective portion being the upper portion above the arch of the opening 2 which serves as a deflecting wall, causing the gases to dip down. Any partition or wall
80 therefore depending a suitable distance below the shell B, so as to cause the gases to dip, will serve the purpose of the wall 1.

H, represent hand-holes for cleaning the combustion chamber and several flues.

Having described our invention, what we claim is:

1. In a furnace provided with a fire-box, a secondary combustion chamber and a bridge-wall, a boiler, a division wall positioned at the front end of said chamber and spaced from the bridge-wall, and extending to the boiler, said division wall being provided with an opening the top of which is depressed a suitable distance from the boiler,
90 a transverse wall rearward of and spaced from the bridge-wall and forming an air flue therewith, the bridge wall being provided with an opening below the fire-box for conducting air into said flue, a second
95 parallel wall rearward of and spaced from the first transverse wall and positioned in front of the division wall aforesaid and forming a flue with said transverse wall, said second wall having openings opposite
100 the opening of the division wall, the said openings being positioned a suitable distance below the top of the opening in the division wall, the portion of the latter wall between the opening thereof and the boiler
105 causing the gases to dip toward the combustion chamber, and the flues aforesaid discharging into the products of combustion as they pass over the bridge-wall.

2. In a furnace provided with a fire-box,
115 a secondary combustion chamber, and a bridge-wall, a boiler, a transverse wall rearward of and spaced from the bridge-wall and forming a flue contiguous thereto, the bridge-wall being provided with openings
120 for admitting fresh air into said flue, a second transverse-wall rearward of and spaced from the first wall and forming a flue contiguous thereto, a transverse deflecting wall depending below the boiler rearward of the
125 second transverse wall and spaced therefrom and extending below the upper edge thereof for causing the gases to dip toward the secondary combustion chamber, the second transverse wall being provided with
130

openings below the bottom of said deflecting wall for returning a portion of the gases from the secondary combustion chamber into the second flue aforesaid, the respective flues and the fire-box discharging into the space between the boiler and the bridge-wall and transverse walls respectively.

In testimony whereof we affix our signatures, in presence of two witnesses.

JAMES G. GRACEY.

EDWARD E. SQUIER.

Witnesses:

EMIL STAREK,

JOS. A. MICHEL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."