

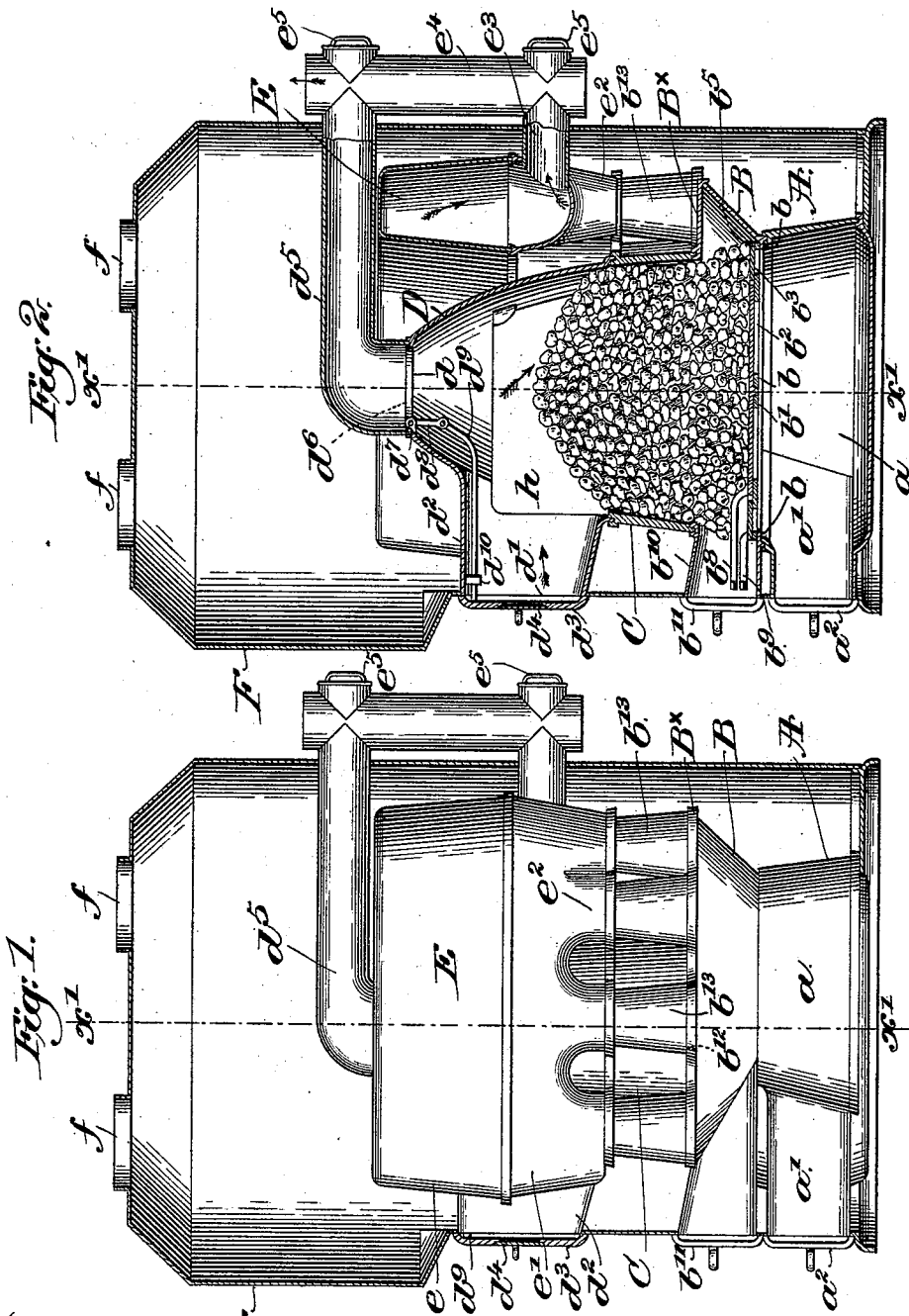
(No Model.)

2 Sheets—Sheet 1.

G. W. WALKER.
FURNACE.

No. 538,030.

Patented Apr. 23, 1895.



Witnesses.
Fred S. Gumbel
Thomas J. Drummond

Inventor
George W. Walker
by Crosby Gregory
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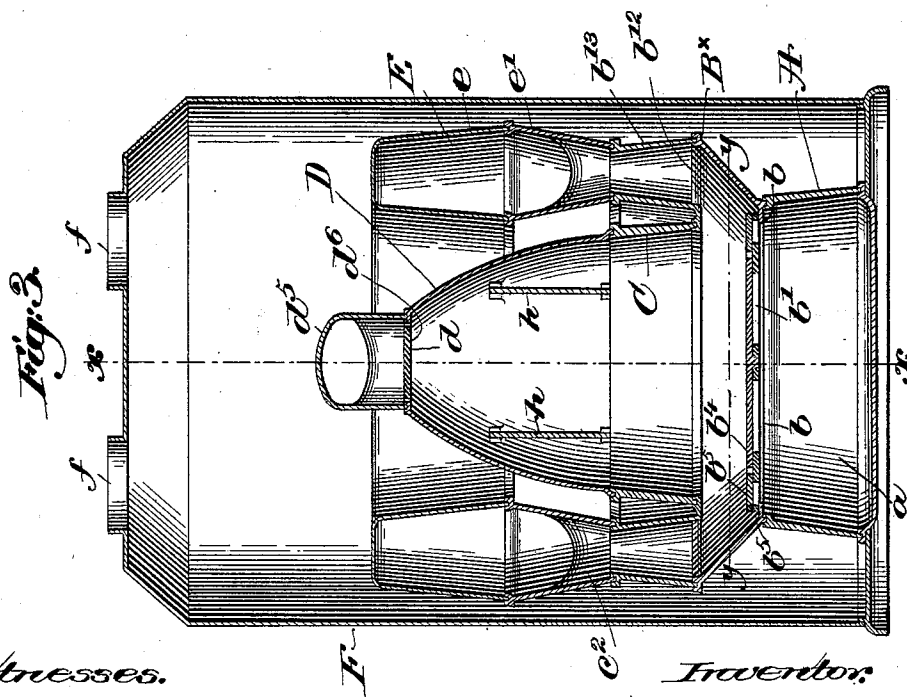
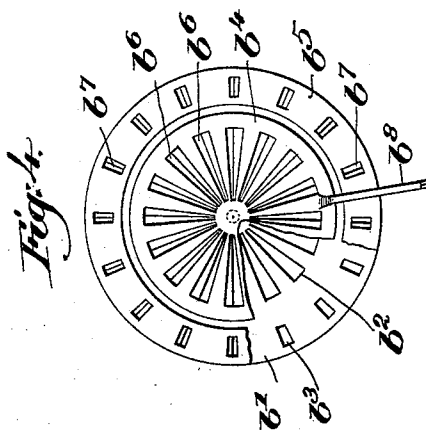
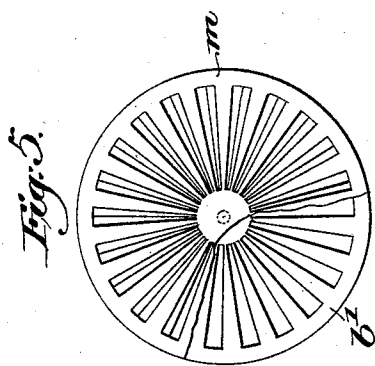
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2 Sheets—Sheet 2.

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Fred S. Grunlof.
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UNITED STATES PATENT OFFICE.

GEORGE W. WALKER, OF MALDEN, MASSACHUSETTS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 538,030, dated April 23, 1895.

Application filed April 2, 1894. Serial No. 506,080. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. WALKER, of Malden, county of Middlesex, State of Massachusetts, have invented an Improvement in Furnaces, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has especial reference to furnaces designed for burning soft or bituminous coal.

To obviate the intense smoke usually produced by the burning of soft coal, it has been common to employ what are known as down draft furnaces, *i. e.*, furnaces in which the smoke outlet is close down to or below the grate, causing a down draft, whereby the gases liberated from the fresh fuel at the surface are consumed in their passage down through the incandescent fuel next the grate. So far as I am aware, furnaces of this type have invariably been provided with a perforated or open grate, and in the course of my experiments I have found that if the ash-pit door be opened, as for removal of the ashes, the air thus admitted to the ash-pit, rises through the grate, and seriously checks the down draft of the furnace, causing the latter to smoke.

One of the principal objects of my present invention is to prevent this smoking when the ash-pit door is opened, and this object I attain by arranging the smoke outlets close down to the grate, and interposing between said smoke outlets and the ash-pit, a means, preferably an imperforate grate or fuel support, to prevent any draft of air from the ash-pit up to the said smoke outlets, so that the down draft to said outlets is unaffected by any opening of the ash-pit door.

The grate or fuel support, if employed to cut off the draft from the ash-pit, may be provided with openings, through which the ashes are dropped into the ash-pit, but suitable means are provided for closing said openings, to thereby prevent a draft when the ash-pit door is opened for the removal of the ashes.

My invention also comprehends a fuel magazine arranged above the grate or fuel support and provided with one or more down draft exit passages leading from at or near

the top of said magazine, whereby the gases liberated within the magazine and prevented from descending through the fuel in the magazine, may yet reach the incandescent layer upon the fuel support and the down draft exit by rising at the top of said magazine and passing downwardly through the said exit passage or passages referred to, thereby preventing the possibility of the accumulation of smoke in the dome above the magazine.

The smoke outlets enter an exit chamber surrounding the combustion chamber and opening thereinto, so that at all times there is free access to the entrances to said outlets. A direct smoke exit is also preferably provided, and fitted with suitable controlling devices, to be hereinafter described.

Other features of my invention will be hereinafter described and pointed out in the claims.

In the drawings, Figure 1 represents in side elevation, one form of furnace embodying my invention, the casing being in section; Fig. 2, a vertical longitudinal section of the furnace shown in Fig. 1, the section being taken on the dotted line $x-x$ Fig. 3; Fig. 3, a vertical cross section taken on the dotted line $x'-x'$ Fig. 1; Fig. 4, a horizontal section below the dotted line $y-y$ Fig. 3, the upper members, being partially broken out to show openings in member b' beneath; and Fig. 5, a plan view showing a modified form of grate or fuel support.

Referring to the drawings, illustrating the preferred construction of furnace embodying my invention, A, is the base, of suitable shape and construction to sustain the other parts, said base containing an ash-pit a , accessible through a neck a' , and an opening therein, normally closed by a door a^2 .

Resting upon the base A, is shown the fuel-supporting section B, preferably cone-shaped, with its greatest diameter at the top, said section, in the present instance, having an inwardly projecting lip b at its lower edge, upon which may rest the fixed member b' of the fuel support, said fixed member, as herein shown, being provided with two sets of radially arranged discharge openings b^2, b^3 , the latter shown as arranged in an annular series outside the former. See Fig. 4:

Co-operating with the lower fixed supporting member b' are two independently movable upper members b^4, b^5 , provided respectively with openings b^6, b^7 , the movable member b^5 being ring-like in form, and surrounding the member b^4 , shown as circular.

When the upper movable members are in one position, their openings b^6, b^7 , register with the openings b^2, b^3 , in the lower fixed member; but by slightly rotating said movable members, said openings may be closed to form in effect an imperforate fuel support.

The movable supporting members b^4, b^5 , are provided respectively with the operating arms b^8, b^9 extended into the neck b^{10} of the section B, close behind the door b^{11} closing said neck.

The two members of the fuel support herein shown and described constitute, in effect, what is commonly known as a register grate, wherein the perforations or openings register when the two members are in one position, and are closed when the two members are shifted into another position.

The fuel-supporting section B, at its top, is partially closed by the wide annular top plate B^x , leaving a large central opening surrounded by a groove in which rests the vertical substantially cylindrical fire wall C, upon which in turn rests the dome D, the latter having an outlet opening d at or near its highest point, and a side feed opening d' at the end of the neck d^2 , said feed opening being normally closed by a suitable door d^3 having a suitable draft slide or opening d^4 for controlling admission of air to the dome.

The annular top plate B^x of the section B, is provided at suitable intervals, see Figs. 1 and 3, with exit or smoke openings b^{12} , communicating with tubes or thimbles b^{13} , on which rest the depending thimbles e^2 of the radiator E, shown as formed in two sections e, e' , said radiator being semicircular in shape, and surrounding but separated slightly from the dome D. See Fig. 3.

An exit pipe e^3 leads from the bottom of the lower radiator section e' , the same entering a vertical pipe e^4 leading to the chimney, a direct draft pipe d^5 , from the dome opening d , also entering said pipe e^4 , as shown in Fig. 2. Opposite the ends of the direct draft pipe d^5 , and exit pipe e^3 , the vertical pipe e^4 is preferably provided with cleaning openings closed by covers e^6 .

I have herein shown the direct draft dome opening d , as normally closed by a damper d^6 hinged at d^7 , and having its depending arm d^8 jointed to the inner end of a rod d^9 supported in a suitable bearing lug d^{10} in the neck d^2 , and at its end resting against the closed feed door d^3 . When the feed door is opened, the damper d^6 drops and opens the direct draft d^5 ; but when the door d^3 is closed, it presses against the rod d^9 and raises and closes the damper d^6 . The parts described are preferably inclosed in a suitable casing or shell F,

provided at its top with the usual exits f , to which the hot air pipes are connected.

In starting a fire, the kindlings are introduced at the feed door, both the direct and the indirect or down drafts being open, and as soon as the kindlings have become sufficiently ignited, the soft coal is deposited upon the same, and the feed door closed, the draft slide d^4 in said door, however, being opened to admit sufficient air to start the fire well under way.

When the feed door is closed, the damper d^6 is also closed, thereby cutting off the direct draft through the pipe d^5 , leaving the fire solely under the action of the down draft through the exit openings b^{12} , thimbles b^{13}, e^2 , radiator E, and pipes e^3 and e^4 . This down draft causes the gases liberated from the fresh coal to be consumed in their downward passage, through the burning kindlings, to the exit openings b^{12} . After a time, additional fuel is put on, the level of the same being thereafter maintained, preferably at or above the feed door.

I have herein shown, and prefer to employ, one or more magazine plates or walls h, h , to hold the fuel, stored in the dome, away from the sides of the latter, for at least a short distance at either side of the feed door. In the furnace shown, these walls h, h , stand at either side the feed door neck d^2 , and extend straight back to meet the wall of the dome at the back of the latter, though said walls may, if desired, be connected at the rear of the dome by a rounded plate to retain the fuel free from the dome at the back as well as at the sides of the latter, said walls constituting a magazine between which the fresh fuel is stored. The fuel deposited in the magazine gradually cokes therein, its gases, when liberated, being drawn down through the body of fuel beneath and consumed by the incandescent layer lying upon the fuel support close to and at the level of the exit openings.

The portions of the supporting section B, of greater diameter than the fire wall, form an annular exit chamber located at the bottom of the body of fuel, and into which said fuel does not work, so that the gases and products of combustion issuing from the sides of the fuel body, at any point, are free to flow around in this annular chamber until they find the most ready exit, thereby giving a strong free draft. This is also especially advantageous when some of the thimbles b^{13} become clogged, for in such event, the gases from any side of the combustion chamber may flow through the annular chamber to those thimbles which are open. The radiator E into which the products of combustion flow, and circulate, furnishes a large heating surface in addition to that furnished by the dome D. As the fire burns, the fuel next the fuel-support is gradually consumed, and the coked fuel above, settles from the magazine, to take its place. The ashes, left by the combustion,

form a protecting layer upon the grate, materially serving to resist burning of the latter; but when it is found necessary to remove the said ashes, to quicken and intensify the fire, the door b^{11} is opened, and a suitable handle is placed upon the end of the arm b^8 , and the said arm and its central movable member b^5 is reciprocated to uncover the openings b^2 in the lower member b' , causing the ashes to drop into the ash-pit. After this the movable member is returned to its normal position, thus closing the openings in the lower member, and the ash-pit door opened for removal of the ashes at leisure, without danger of in the least checking the draft of the furnace above the closed fuel support.

Should the ashes collect in the annular chamber within the section B, more rapidly than upon the center of the support, or require removal oftener, the annular movable member b^5 may be shaken independently of the center member by means of the arm b^9 , and if the coking fuel in the magazine requires loosening, a poker may be introduced through the side feed door, or the draft openings therein for that purpose.

Should the fire become extinguished, while the furnace and magazine are filled with fuel, a few kindlings may be placed upon the top of the fuel in the magazine, the down draft causing the flames from the kindlings to quickly ignite the entire body of fuel below it.

By leaving a space between the sides of the magazine walls h , h , and the walls of the dome, a better circulation of the gases in the furnace is obtained, and if at any time the fuel in the magazine becomes packed in so solid as to prevent the gases working down through, the said gases may rise and pass down outside the walls h , h , to the incandescent fuel below, next the grate.

Clinkers may be removed by a poker introduced at the door b^{11} .

In Figs. 1 to 4 inclusive, I have shown two independent movable fuel-supporting members b^4 and b^5 , but, if desired, the center member may be made of sufficient size to reach quite to the periphery of the lower fixed member b' , as shown at m in Fig. 5.

In the construction Fig. 5, it would not be possible to free the ashes from the annular exit chamber B^x without also removing the ashes from above that portion of the fuel-support which constitutes the bottom proper of the combustion chamber.

The neck b^{10} is made of sufficient size to admit the fuel-supporting members when setting up the furnace, the door b^{11} being either double or single and attached to a removable plate closing the end of the said neck.

This invention is not restricted to the particular construction of furnace herein shown, for it is evident the same may be varied in many ways and still come within the scope of the invention, which consists broadly in interposing between the ash-pit and the down draft exit openings some means, either co-op-

erating with or independent of the fuel support, for cutting off or preventing a draft from the ash-pit to said exit openings which would interfere with the regular down draft of the furnace, and cause smoking.

While I have herein shown my invention embodied in a portable house-heating furnace, yet the invention may be embodied in steam generators and other furnaces of a more or less permanent kind.

If desired, the ash-pit door, or a slide therein, may be kept open to admit air below, and to cool the fuel-support.

The term "imperforate fuel-support" employed in the claim, means a support actually imperforate; or a perforated support with suitable means for closing the perforations to render it substantially imperforate while the ash-pit door is open.

While I prefer to use the magazine plates because of the advantages hereinbefore described, yet this invention is not in all instances limited to their use; nor is my invention limited to the number or shape of the openings in the fuel support; which openings, when necessity requires, may serve for the passage of ashes; nor is my invention limited to the exact form or construction of fuel support or wall interposed between the coal and the ash-pit so long as the passage of air from the ash-pit to the exit-openings, as described, is entirely stopped.

I claim—

1. In a furnace, the combination with a combustion chamber having an air inlet opening above a main mass of fuel, of a fuel support at the bottom of said chamber, one or more exit openings for the products of combustion contiguous to the said fuel support, an ash pit communicating with said exit openings, and means to regulate or cut off the passage of air from the ash pit to said exit openings, substantially as described.

2. In a furnace, the combination with a combustion chamber having an air inlet opening above a main mass of fuel, of a fuel support at the bottom of said chamber and provided with one or more perforations, one or more exit openings for the products of combustion above and contiguous to the said fuel support, an ash pit communicating with the said exit openings through the perforations in the said fuel support, and means for closing the said perforations to render the said fuel support substantially imperforate to thereby cut off the passage of air therethrough from the ash pit to the said exit openings, substantially as described.

3. In a furnace, the combination with a combustion chamber having an air inlet opening above a main mass of fuel, of a register grate constituting a fuel support at the bottom of said chamber, one or more exit openings for the products of combustion above and contiguous to the said grate, and an ash pit communicating with the said exit openings through the openings in the said regis-

ter grate, the said register grate furnishing means for closing the openings therein and thereby cutting off the passage of air from the ash pit to the said exit openings, substantially as described.

4. In a furnace, the combination with a combustion chamber having an air inlet opening above a main mass of fuel, of a fuel support arranged at the bottom of the said combustion chamber, an exit chamber encircling and opening throughout its length and without substantial obstruction into said combustion chamber above and contiguous to said fuel support, whereby the products of combustion freely enter the said encircling exit chamber at any point to flow there-through to any one of the exit passages; a plurality of exit passages leading from the said exit chamber; an ash pit communicating with the said exit chamber; and means to cut off the passage of air from the ash pit to the said exit chamber, substantially as described.

5. In a furnace, a combustion chamber having an air inlet opening above a main mass of fuel, an exit chamber encircling and opening into the said combustion chamber at the bottom of the latter, the bottoms of said combustion and exit chambers having perforations for the discharge of ashes, an ash pit communicating through the said perforated bottoms with the said exit chamber, and means to open and close the said perforations in the respective chambers to regulate or cut off the passage of air from the ash pit to the said exit chamber, substantially as described.

6. In a furnace, the combination with a circular combustion chamber having an air inlet opening above a main mass of fuel, of a fuel support at the bottom of said chamber, one or more exit openings for the products of combustion contiguous to the said fuel support, an ash pit communicating with the said exit openings, means to regulate or cut off the passage of air from the ash pit to the said exit openings, a feed-opening for the said combustion chamber, and magazine plates arranged at opposite sides of the feed opening and extend-

ing across and to the opposite curved wall of the said combustion chamber to confine between them the mass of fuel, the spaces at the sides of and between the said magazine plates and the walls of the said combustion chamber constituting passages through which the liberated gases obstructed in their downward passage through the main mass of fuel may rise and pass down through to the exit openings, substantially as described.

7. In a furnace, the combination with a combustion chamber having an air inlet opening above a main mass of fuel, of a fuel support arranged at the bottom of said chamber, an exit chamber at the bottom of and opening into the said combustion chamber and having a downwardly and inwardly inclined wall whereby all collections of soot, &c. are directed inwardly toward the said combustion chamber, an ash pit communicating with the said exit chamber, and means to regulate or cut off the passage of air from the ash pit to the said exit chamber, substantially as described.

8. In a furnace, the combination with a combustion chamber having an air inlet opening above a main mass of fuel, of a fuel support at the bottom of said chamber, an exit chamber encircling and opening throughout its length and without substantial obstruction into said combustion chamber above and contiguous to the said fuel support, a radiator encircling the said combustion chamber above the said exit chamber, a plurality of exit pipes leading from the said exit chamber to the said radiator, an outlet for the latter, an ash pit communicating with the said exit chamber, and means to cut off the passage of air from the said ash pit to said exit chamber, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE W. WALKER.

Witnesses:

GEO. W. GREGORY,
FREDERICK L. EMERY.