(Model.) 2 Sheets—Sheet 1.

G. B. FIELD.

FURNACE.

No. 267,068. Patented Nov. 7, 1882.

Fig. 1.

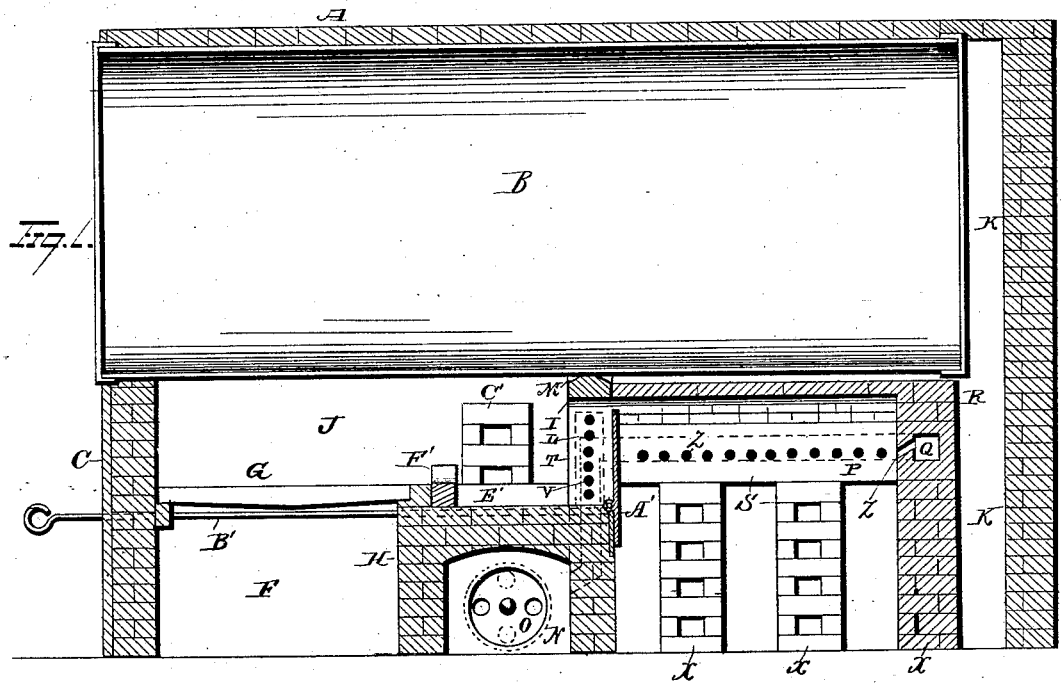
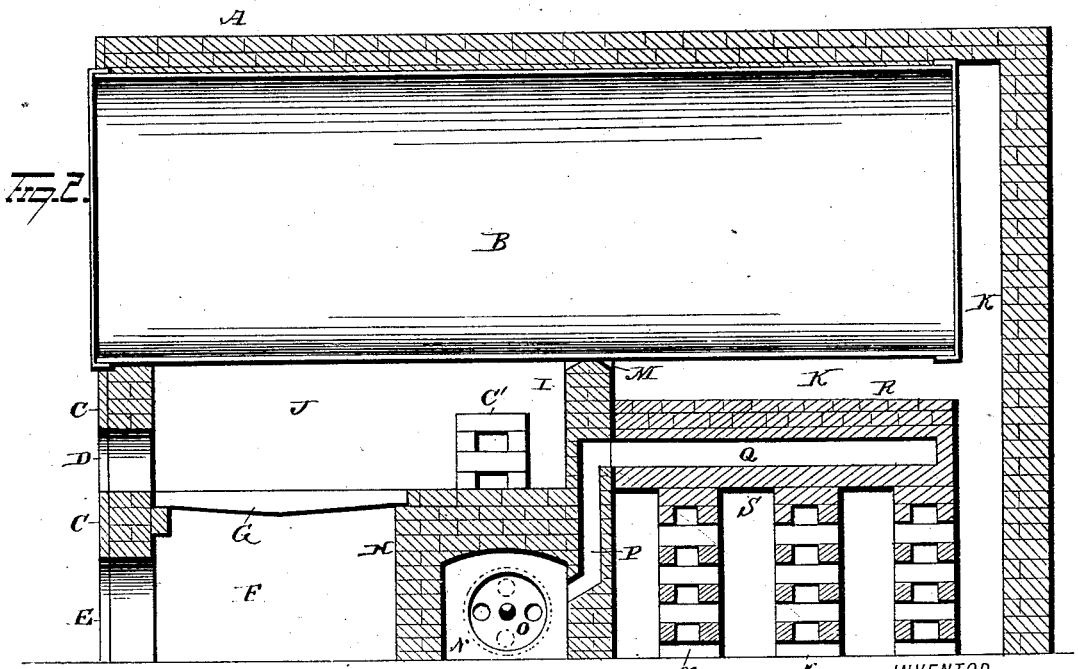


Fig. 2.



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(Model.) 2 Sheets—Sheet 2.

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Fig. 3.

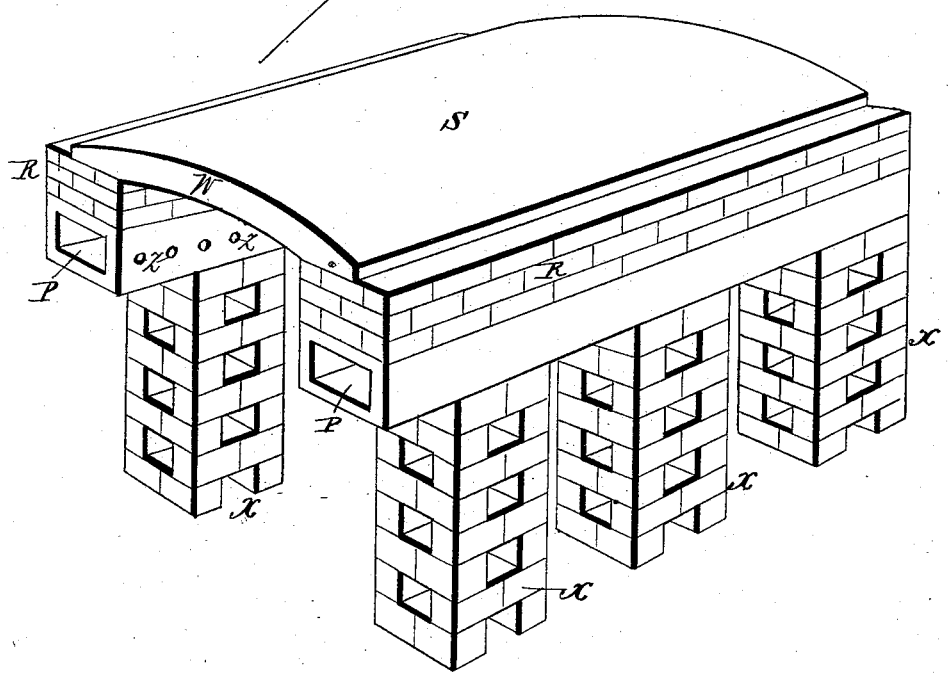
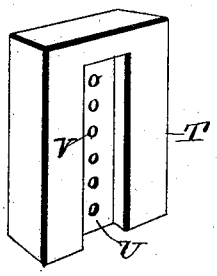


Fig. 4.



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UNITED STATES PATENT OFFICE.

GEORGE B. FIELD, OF NEW YORK, N. Y.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 267,068, dated November 7, 1882.

Application filed February 11, 1882. (Model.)

To all whom it may concern:

Be it known that I, GEORGE B. FIELD, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Furnaces; 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 pertains to make and use the same.

My invention relates to an improvement in furnaces designed to be used for heating steam-boilers or for other similar purposes, the chief object of the invention being the construction of a commingling-chamber wherein the unconsumed carbon and the various gases of combustion are oxygenated and burned.

A further object of my invention is to provide a device for limiting to the normal quantity the flow of unconsumed carbon and gases into the commingling-chamber, when such carbon and gases are evolved in unusual quantities in the fuel-chamber by reason of a reduction of temperature therein.

A further object of my invention is to provide means of heating atmospheric air and of introducing it into the commingling-chamber.

A further object of my invention is the construction of a furnace wherein the boiler is relieved of those conflicting contractions and expansions caused by unequally heating it, and which result in molecular changes impairing its strength.

With these ends in view my invention consists in certain details of construction and combinations of parts, as will be more fully hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in vertical longitudinal section of a furnace constructed in accordance with my invention. Fig. 2 is a similar view taken through one of the side walls of the commingling-chamber. Fig. 3 is a view in perspective of the commingling-chamber, and Fig. 4 is a view of one of the auxiliary heating-flues.

A represents a furnace of any desired construction, and provided with a boiler, B, mounted in it in the usual manner. The front wall, C, of the furnace is provided with doors D for the introduction of fuel, and with doors E, leading into the ash-pit F.

The grate G may be of any approved form of construction, and capable of being shaken or not. Its outer end rests upon a ledge secured to the inner face of the wall C, while its inner end is supported upon the edge of the shelf H, which extends rearward to the vertical wall I. The said wall I is built of suitable fire-clay tiles of high resistance, and arranged to completely interrupt communication between the fuel-chamber J and the combustion-chamber K, save only through the aperture L, which is formed in said wall at a point below the boiler, and which is designed to permit the passage of the gases of combustion from the chamber J, when they are evolved, to the chamber K, where they are mingled with air and completely consumed. Owing to the intense heat to which the said wall is subjected, it is necessarily of considerable thickness, and it is apparent that if it were carried up to the boiler without a diminution in thickness it would cut off a portion or belt of the same, both from the direct action of the heat derived from burning fuel in the fuel-chamber and from the heat derived from the burning gas in the combustion-chamber, the said belt being heated by the heat of conduction derived from the wall itself. It would therefore follow that those portions of the boiler located on each side of the portion surrounded by the wall would be heated to a far higher temperature than such portion. The conflicting expansions and contractions due to such unequal heating will cause molecular changes in the iron of such character as to result in a rapid deterioration of strength in the boiler. In order to avoid this, I bevel the wall, as seen at M, so that it is reduced to such thickness at the point where it meets the boiler that the portion thereof which is excluded from the direct action of the heat derived from the combustion of fuel and gas is so narrow that the heat imparted to contiguous portions of the boiler is readily transmitted through it. In this way the temperature of the boiler is equalized and the boiler preserved. If desired, instead of beveling or contracting the wall I, the boiler may be encircled by a suitable iron ring, and the wall built up to that.

The shelf H, which is built of fire-brick, incloses an oven, N, into which atmospheric air is introduced through the damper O, the

said damper being adapted to regulate the amount of air admitted into the oven. After the air has been heated in the oven by the heat of conduction and radiation derived from its upper and side walls it ascends through the flues P and escapes into the horizontal flues Q, located in the side and end walls, R, of the commingling-chamber S. A portion of the heated air rises into the auxiliary flues T through independent air-flues or through passages offsetting from the flue P. The said flues T are located in vertical position on appropriate sides of the aperture L, which may be said to constitute the throat of the furnace. They are formed with interior chambers, U, which receive heated air from the oven, as described, and with small air-perforations V, which lead from the chambers U to those surfaces of the flues which face the aperture L. If desired, the said surface may be provided with corrugations to momentarily detain the gases which flow through the aperture, and thus effect a more thorough intermingling and blending of the air issuing from the passages V with the said gases.

The commingling-chamber S is located in the combustion-chamber K of the furnace. The drawings show it to be arranged longitudinally with reference to the boiler; but it may be arranged transversely or obliquely with reference to the same. It is built preferably of fire-brick or tiling; but any other suitable material may be employed. It consists of side and end walls, R, in which the flues P are located, of the arch W, resting upon the upper faces of the walls, and of the columns X. Communication between the spaces Y, inclosed by the walls R and the said flues, is established by rows of perforations Z, which extend throughout the length of the inner faces of each of the flues.

The walls R, together with the arch W, are supported by columns X, of open brick-work; but, if desired, the said columns may be made without openings, or they may be entirely dispensed with and substituted by a perforated wall of masonry, or by a series of arches; but whatever form of construction may be adopted the openings formed in the structure designed to support the walls R and their connecting-arch will constitute issues for the products of combustion and for the burning gases if they are not completely consumed within the commingling-chamber. When the doors of the furnace are opened a rush of cold air into the fuel-chamber is occasioned, which effects the reduction of the temperature therein below that point at which the disengaged carbon or smoke is burned, and in consequence thereof a greater quantity of smoke is evolved than the commingling-chamber is capable of consuming, and if the flow thereinto is not limited for the time being to the normal quantity the furnace will smoke. In order to avoid this, the aperture L is provided with a damper, A′, adapted to be operated by the rod B′, which projects through the front wall of the furnace. The damper may be formed of a slat of soapstone or of a tile of fire-clay, or yet of any material capable of withstanding the action of the heat present at this point. In the drawings the damper is shown as being pivoted to the bottom of the aperture L, in which it is elevated by the rod B′; but it is obvious that different arrangements may be devised for securing it in position and for operating it. It will be observed that the damper does not, when elevated, completely close the aperture L, but that space is left between it and the top of the aperture, for it is intended that as much smoke shall be admitted into the commingling-chamber as can be completely consumed there.

For the purpose of maintaining a practically, even temperature within the furnace, notwithstanding fluctuations in the amount of the heat generated, structures C′, of fire-brick, are employed, the said structures being located on the shelf H, on each side of the aperture L, in the wall I. Inasmuch as they are in direct contact with the flames which spring from the fuel near them, and with the hot gases of combustion, they will absorb great quantities of heat, which will be radiated from them and diffused through the furnace when the temperature thereof is lowered. Similar structures or piles of brick may also be disposed at convenient points in the combustion-chamber. These structures are particularly valuable in sustaining the gases of combustion at that temperature at which they burn.

Referring again to the shelf H, it may be observed that its depth or width will depend in great measure upon the character of the boiler employed, upon the normal pressure of steam to be maintained, and upon various structural characters of the furnace. Ordinarily, however, the best results are obtained from a broad shelf, for any increase in its width prolongs the caloric-current, which the draft of the furnace carries rearward, and which may be said to consist of burning hydrocarbons and the other gases evolved by combustion which burn with the fuel-chamber, and also those gases evolved which do not burn until mingled with the oxygen of the air. It is well known that the greatest heating effect of fuel is derived from this caloric-current, and therefore any prolongation of it will increase the percentage of heat from a given amount of fuel. The upper face of the said shelf is provided with a recess, E′, which is designed to give additional room between the boiler and the shelf, and virtually enlarge the aperture L. The recess E also offers a suitable shelter for the damper A′. A grating, F′, set up in the forward end of the recess is designed to prevent the fuel from entering it.

Having described my improved furnace in detail, I will now briefly set forth its method of operation.

Fuel is introduced into the fuel-chamber and

ignited. The burning carbon and gases evolved, together with those gases evolved which will not burn until after oxygenation, are carried rearward by the draft of the furnace and prolonged by the shelf H. When the current reaches the aperture L it will be mixed with heated atmospheric air, which is forced in jets through the perforations in the flues T; but the gases contained in the current will not be completely oxygenated until they reach the commingling-chamber S, where they receive additional supplies of air from the flues R. In the chamber the gases ignite and burn with the evolution of intense heat, the products of combustion being forced downward and out of the issues in the structure by which the commingling-chamber is supported. Generally the gases will be completely consumed in the commingling-chamber; but if the inflow of gas from the aperture L forces the oxygenated gases out of the chamber before they are consumed, their combustion will be completed in the combustion-chamber.

It is apparent that in conforming my device to the varying demands of circumstances, as I design to apply my improvements to furnaces already built, it will be necessary to make some changes and alterations, which, while not deviating from the principle on which the improvements are based, will cause some deviations from the furnace illustrated in the drawings. I would therefore have it understood that I do not limit myself to the exact construction shown and described, but hold myself at liberty to make such slight changes and alterations as fairly fall within the spirit of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a commingling-chamber having closed side and rear walls supporting an imperforate arch or top, said walls being provided with flues adapted to introduce atmospheric air into the open space inclosed by them, of a structure, provided with issues, to support said chamber in an elevated position, and forming an open space below it, substantially as set forth.

2. The combination, with a fuel and a combustion chamber, of a wall located between said chambers and having an aperture formed in it, a commingling-chamber located in the combustion-chamber, having closed side and rear walls supporting an imperforate top or arch, and provided with flues adapted to introduce atmospheric air into the space inclosed by said walls, and a structure, provided with issues, to support the commingling-chamber in an elevated position in the combustion-chamber, one end of said chamber being open to admit the caloric-current, substantially as set forth.

3. The combination, with a fuel-chamber and a combustion-chamber, of a wall located between said chambers and having an aperture formed in it, flues located in said aperture, a closed oven located within the fuel-chamber, arranged to prolong the caloric-current, and having communication with the outer air, and passages leading from the oven to the flues aforesaid, substantially as set forth.

4. The combination, with a fuel-chamber and a combustion-chamber, of a wall located between said chambers and provided with an aperture, of a commingling chamber, located in the combustion-chamber, having closed side and rear walls supporting an imperforate top, and provided with flues to introduce atmospheric air into the space inclosed by said walls, a closed oven located in the fuel-chamber and communicating with the outer air, and passages leading from said oven to the flues in the commingling-chamber, substantially as set forth.

5. The combination, with a fuel-chamber and a combustion-chamber, of a vertical wall located between said chambers and having an aperture formed in it, and a damper having its lower end pivotally secured to said wall, and adapted, when elevated, to partially close the aperture therein, substantially as set forth.

6. The combination, with a fuel-chamber and a combustion-chamber, of a vertical wall located between said chambers and provided with an aperture, and a damper having its lower end pivotally secured to said wall, and adapted, when elevated, to partially close the aperture in the wall, leaving a narrow space between the upper end of the damper, and provided with a recess to receive the damper when depressed, substantially as set forth.

7. In a furnace, the combination, with a fuel-chamber, of a shelf located in the rear end of said chamber, and arranged to prolong the caloric-current, said shelf being provided with a recess to give additional room between the boiler and the shelf.

8. In a furnace, the combination, with a fuel-chamber, of a shelf located in the rear end of said chamber and arranged to prolong the caloric-current, said shelf being provided with a recess to give additional room between the boiler and the shelf, and a grate located in the forward end of said recess.

9. In a furnace, the combination, with a fuel and a combustion chamber, of a wall located between said chambers, and provided with an aperture, flues located in said aperture, a commingling-chamber located in the combustion-chamber, and a shelf located in the fuel-chamber, and inclosing an oven provided with flues arranged to convey heated air to the flues located in the aperture aforesaid and to the flues of the commingling-chamber.

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

GEORGE B. FIELD.

Witnesses:
JOHN FARRELL,
C. E. BROWN.