

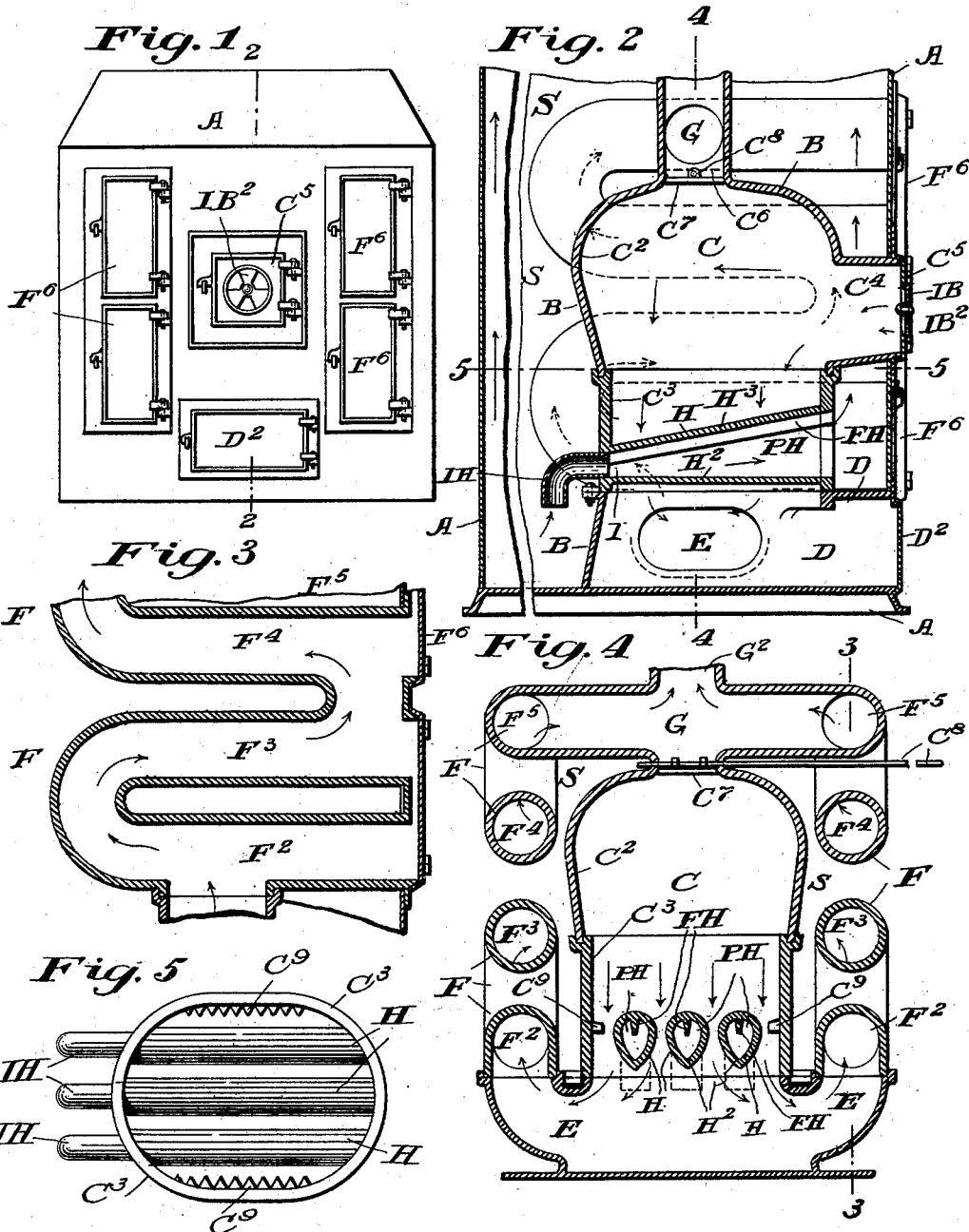
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C. H. BENNETT.
FURNACE, STOVE, OR FIREPLACE.

(Application filed Feb. 25, 1899.)

(No Model.)



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FURNACE, STOVE, OR FIREPLACE.

SPECIFICATION forming part of Letters Patent No. 647,552, dated April 17, 1900.

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To all whom it may concern:

Be it known that I, CHARLES H. BENNETT, a citizen of the United States, and a resident of the city of Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Furnaces, Stoves, or Fireplaces, of which the following is a specification.

One of the principal objects of my invention is to obtain a downdraft through the burning fuel, and thus to more perfectly consume the fuel. The tendency in combustion where the fuel is fed or thrown onto the fire from above is to cause the lower portion of the fuel to be incandescent. That portion of the fuel which is above is caused to throw off its volatile products of combustion. Where the draft of air fed to the fuel enters below the fuel and passes up through the latter, the incandescent volatile products of combustion from the superincumbent freshly-added fuel pass up and away from the fire and much of them (especially in bituminous coal) are not consumed, but pass out of the chimney in the form of smoke. In such escaping products there also passes a quantity of unconsumed carbon. The waste therefore is apparent.

By my invention the products of combustion—gases, carbon, and the like—escaping from the coal at the top of the fire are carried down into contact with the incandescent fuel by the downdraft of air and are there thoroughly consumed.

Another object of my invention is such a construction of one or more grate-bars for supporting this fuel as shall enable the grate-bars to be kept cool, and therefore prevent these bars from being melted or burned out by the heat of the fire being carried down against them and past them by the downdraft aforementioned.

Another object of my invention is to utilize the heat communicated to the grate bar or bars by heating air, which may be carried to any place where the hot air is needed.

The several features of my invention and the various advantages resulting from its use, conjointly or otherwise, will be fully apparent from the following description and claim.

In the accompanying drawings, making a

part of this application, similar letters of reference indicate corresponding parts.

My invention is applicable to various kinds of furnaces, stoves, and grates.

Inasmuch as the invention is thoroughly illustrated by showing it as applied to a warm-air furnace, I have in the drawings shown one kind of warm-air furnace and the application of my invention thereto.

In the drawings, Figure 1 is a front perspective view of a warm-air furnace to which my invention has been applied. Fig. 2 represents a vertical central section of the furnace, taken in the plane of the dotted line 2 2 of Fig. 1. In this view a part of the rear portion of the furnace unnecessary to the comprehension of my invention and containing merely a hot-air space is broken out and removed and the rear end of the furnace brought forward, as shown. The object of this condensation is to economize space on the sheet of drawings. Fig. 3 represents a portion of a vertical central section of a portion of the side exit-flues. This section is taken in the plane of the dotted line 3 3 of Fig. 4. Fig. 4 is a vertical central transverse section of the furnace, taken in the plane of the dotted line 4 4 of Fig. 2. Fig. 5 is a plan view of the grate-bars and of those portions of the furnace-wall and of its projections which are in the immediate vicinity of these bars.

The outer enveloping shell or casing A is to be of any desired shape. At or near the bottom thereof is a suitable cold-air inlet to admit cold air to be heated for useful and well-known purposes. Within this casing, but separated therefrom at a sufficient distance to allow hot air heated by the furnace to freely rise is the furnace B itself. In this furnace C is the fire-pot, composed of the lower division C¹ and the upper division C². The upper division has the inlet feed-passage C³, closed by the usual door C⁴. Air to feed the fire and to create a draft regulated by a suitable door is admitted through a suitable opening in the feed-door. This opening is located above the point where the charge of fuel comes when the furnace is properly filled. In the present illustrative instance the air-inlet IB is in and through an opening in the door C⁴, and this inlet-passage is con-

trolled by a door IB². At the upper portion of the furnace is the exit smoke-flue C⁶. Inasmuch as the usual course of the waste products of combustion—smoke, &c.—is downward through the furnace, this exit-flue C⁶ is usually closed by a draft-damper C⁷. This door may be operated by a rod C⁸ or otherwise.

Suitable provision is made to receive the waste products of combustion after they pass down through the grate and into the ash-pit. A practical and novel provision for this purpose is shown and consists as follows, viz: This provision is in duplicate, there being one such on each side of the ash-pit and furnace. A description of one will suffice for both, viz: In the side of the ash-pit D is an opening E, and this connects with an exit-flue F, which is arranged so as to curve back and forth within the casing A. Thus it (this flue) is enabled to come into contact with a large amount of air and to transmit its heat to the latter. The exit end of this flue F connects with the exit passage or chamber G, in turn connecting with an exit-flue G². It is to be noted that the upper end of the furnace through the exit C⁶ does, when the flue-door is open, connect with such passage or chamber. The several windings or branches of the flue F are respectively represented by the characters F², F³, F⁴, and F⁵.

I will now proceed to describe the means for sustaining the fuel in the furnace. I provide one or more grate-bars H. These are not common grate-bars, but ones that are tubular. Solid grate-bars would soon burn out for the reason that a downdraft carries the flame and heat into constant direct contact with the bars after the manner of the blowpipe, and the ordinary bars would soon warp and melt under the intense heat to which they are necessarily subjected. Through each of these tubular grate-bars H, I pass a rapidly-moving current of air, and the air thus passed takes the heat of the grate-bars, and thus highly heated passes into the space S between the casing A and the furnace B and is conducted thence ordinarily to be used along with the other heated air of the furnace.

I am aware that water has been passed through ordinary tubes to keep the latter cool while used as grate-bars in steam-boilers. I employ air instead of water, inasmuch as water cannot be always obtained without expense and its use in such connection would entail the attendance of an operator to operate it and is, in fact, wholly impracticable in such a furnace.

I obtain in the use of air means for cooling the grate which are very economical and entirely practicable. In addition to providing a construction wherein tubular grate-bars and means for enabling air to pass through them are present, which construction and means constitute one feature of my invention, I have invented the following novel construction of the fire-grate bars themselves, to wit: In or-

der to pass the air through at a proper speed, I must provide for the expansion of the air during the operation of heating it. This is done by flaring or tapering the hollow grate-bar. I cause the amount of flare to be proportionate to the intensity of the heat to which the grate-bars will ordinarily be subjected, because the degree of expansion of the air as it passes through the grate-bars will depend upon the amount of heat which it receives. Thus the flare of the tubular space within the grate-bar will rightly accommodate the moving air in the course of its expansion as it passes within and through the grate-bars. While the roof and floor of the space within the grate-bar may each incline, the one upward and the other downward from the horizontal, or the roof may be horizontal while the floor inclines downward, yet the preferred directions of the floor and roof are as shown. I have thus inventively located them (see Fig. 2) in order to the better enable them to carry into effect the purposes of my invention. Therefore I have located the floor H² in a horizontal plane and the roof H³ of the grate-bar in a plane inclined to the horizontal. Thus where the tubular space of the bar has a given flare the angle of the inclination to the horizontal will be greater than where the floor inclines down from the horizontal. This great inclination of the roof possesses a great advantage, to wit: It allows the heated air a good opportunity to easily pass off through and from the tubular passage PH of the grate-bar in a natural rising current. Such an inclination of the roof of this tubular passage does not necessitate any further thickening of the grate-bar in the neighborhood of the inlet end I of the passage PH through it, because by locating the inlet ends of the bars—viz., at that side of the furnace opposite where the feed-door is located—as I have shown the inclination of the tops of the bars is downward from the doors, and this is an advantage, as it enables the fuel to be well handled by the poker and causes the fuel to bank in a position where it can be readily reached by draw-bar or poker operated through the feed-door.

In order to increase the capacity of the grate-bars for transmitting heat to the air passing through them, (whenever such increased capacity is needed,) I provide within this bar a flange or flanges or projections FH, which extend into the tubular space of the bar and transmit heat from the latter to the air contained within. In other words, I increase the surface of the grate-bar which comes in contact with the air moving through it. Thus I transmit the heat more rapidly to the air and heat the latter more rapidly, increase the speed with which it (the air) passes through the grate-bars, and am thereby enabled to heat the air from this source more quickly and at the same time keep the grate-bars cooler and in a condition wherein they are but little liable to be injured from the heat in con-

tact with their exterior surface. The shape of these bars and their (interior) spaces in cross-section may be varied as desired. A preferred shape thereof is shown in Fig. 4, where the grate-bars and the tubular passage are alike heart-shaped, the narrower or pointed portion being below. Such a shape confers upon the grate-bar great resistive strength in a vertical direction. This is the direction—viz., from above downward—in which the greatest pressure is exerted upon the grate-bars. The bottom of the bars being narrow affords the ashes falling between adjacent bars or between the bars and the adjacent sides of the fire-pot better opportunity to pass down and leave these spaces clear for the passage of the downdraft through them.

It is to be understood that the application of my invention is not to be limited to any special shape of fire-pot or those other accompanying portions of the furnace which are old, well known, and are to be found in many shapes and forms in common use.

The downdraft, irrespective of the particular shape of the grate-bars aforementioned, keeps the fire substantially clear of ashes, as the draft carries the latter down between the grate-bars into the ash-pit.

The mode in which my invention operates is as follows: The fuel is placed upon the grate-bars H and lighted. The upper exit or door C⁷ in the roof of the fire-pot is opened until the fire has become thoroughly kindled. This door C⁷ is then closed and the air entering through the inlet-port IB of the door C⁸ passes down through the fuel and between the grate-bars, and thence down and through the passage E into the flues F and rising passes through these flues F into the exit flue or chamber G, and thence out through the exit-flue G². By these means the flues F, &c., are heated and transmit their heat to the air within the casing A in the usual manner. This heated air is, as customary, conveyed to the place or places where it is needed. The grate-bars soon become heated and transmit their heat to the air within them. This air expands and moves through the tubular space PH of each grate-bar H and out of the enlarged end thereof and passes upward into the space between the furnace and casing and goes past the feed inlet-passage C⁴, as shown in Fig. 6, and adds to the hot air, (aforemen-

tioned,) which is to be conveyed to the point or points where needed. Meanwhile the cold air entering the inlet end of the tubular bars H, preferably by means of an introductory tube IH, passes into and through said grate-bars and keeps the latter at a comparatively low temperature by withdrawing heat from the bars and conveying it onward, as aforementioned. On the drawings arrows duly indicate the respective directions of the various aforementioned currents of air.

From the foregoing description of the construction and mode of operation of my invention it is believed that the latter will be readily understood.

Where the fire-pot C⁸ is circular or oval in the planes of the grate-bars, a frill or other suitable projection or projections C⁹ may be present to partially fill the space between the inner side of the pot and the adjacent grate-bar, substantially as shown.

To enable those not fully skilled in the art to understand the use of certain parts not heretofore described and forming no part of my invention, I here specify that the doors F⁶ (indicated in Figs. 1 and 4) give access to the branches F², F³, F⁴, and F⁵ of the flues F, so that the latter may be inspected, cleaned, and repaired.

D² indicates the usual door of the ash-pit, through which access may be had to the ash-pit and to the under side of the fire-grate bars.

My invention is especially applicable to furnaces; but, as heretofore indicated, my invention is applicable not only to furnaces but also to the fireplaces of stoves and other fireplaces.

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

In a furnace or the like, a fire-pot, feed-door, and inlet, and the grate-bars H, having passages PH through them, inlet-ports to these passages, the latter flaring, as they approach their outlet, the bottom of the bars lying in a horizontal plane, and their tops inclined, substantially as and for the purposes specified.

CHARLES H. BENNETT.

Attest:

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K. SMITH.