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 ART OF BURNING FUEL IN FURNACES FOR BOILERS, &c.
 APPLICATION FILED DEC. 20, 1906.

925,632.

Patented June 22, 1909.

FIG. 1.

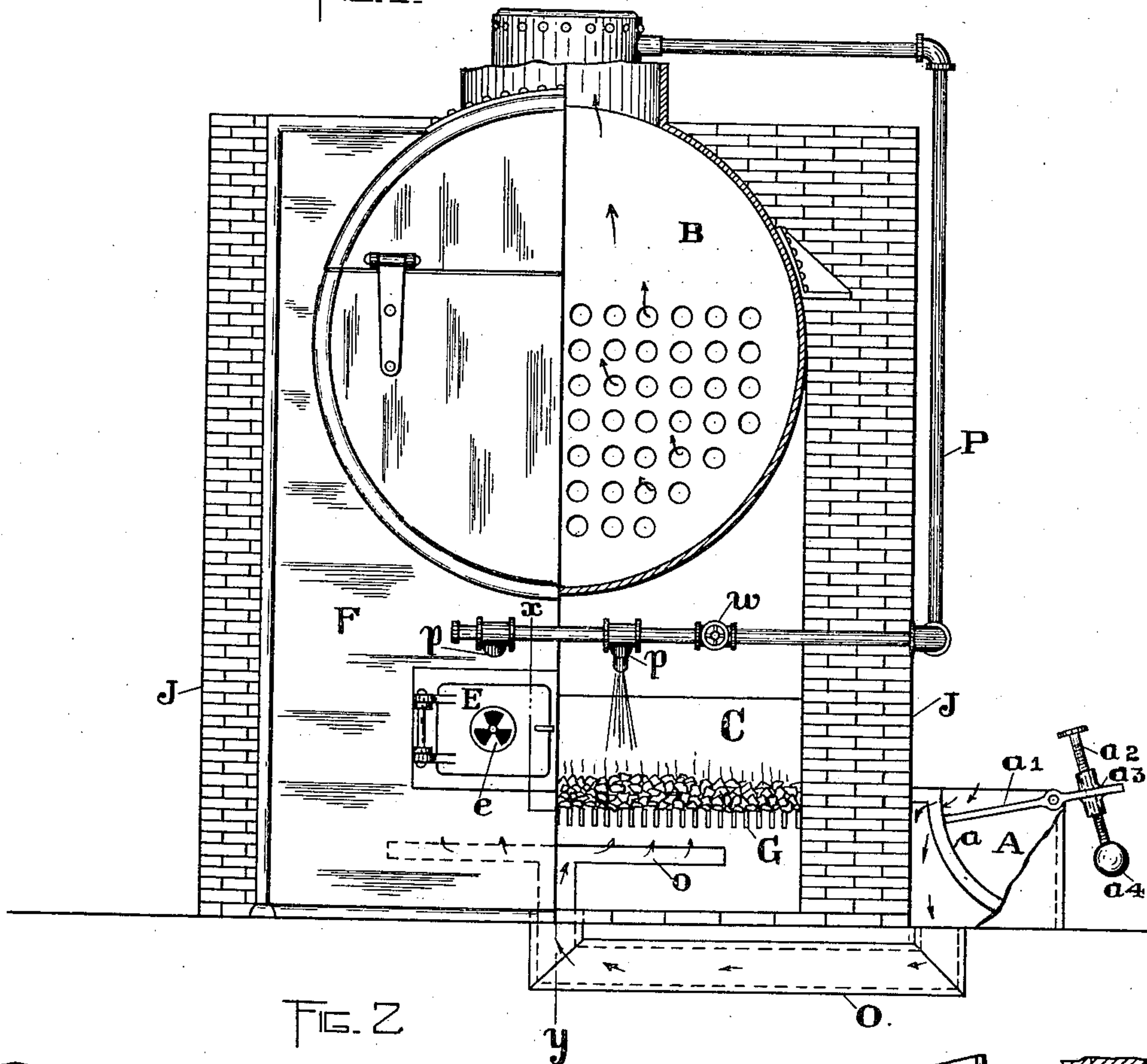
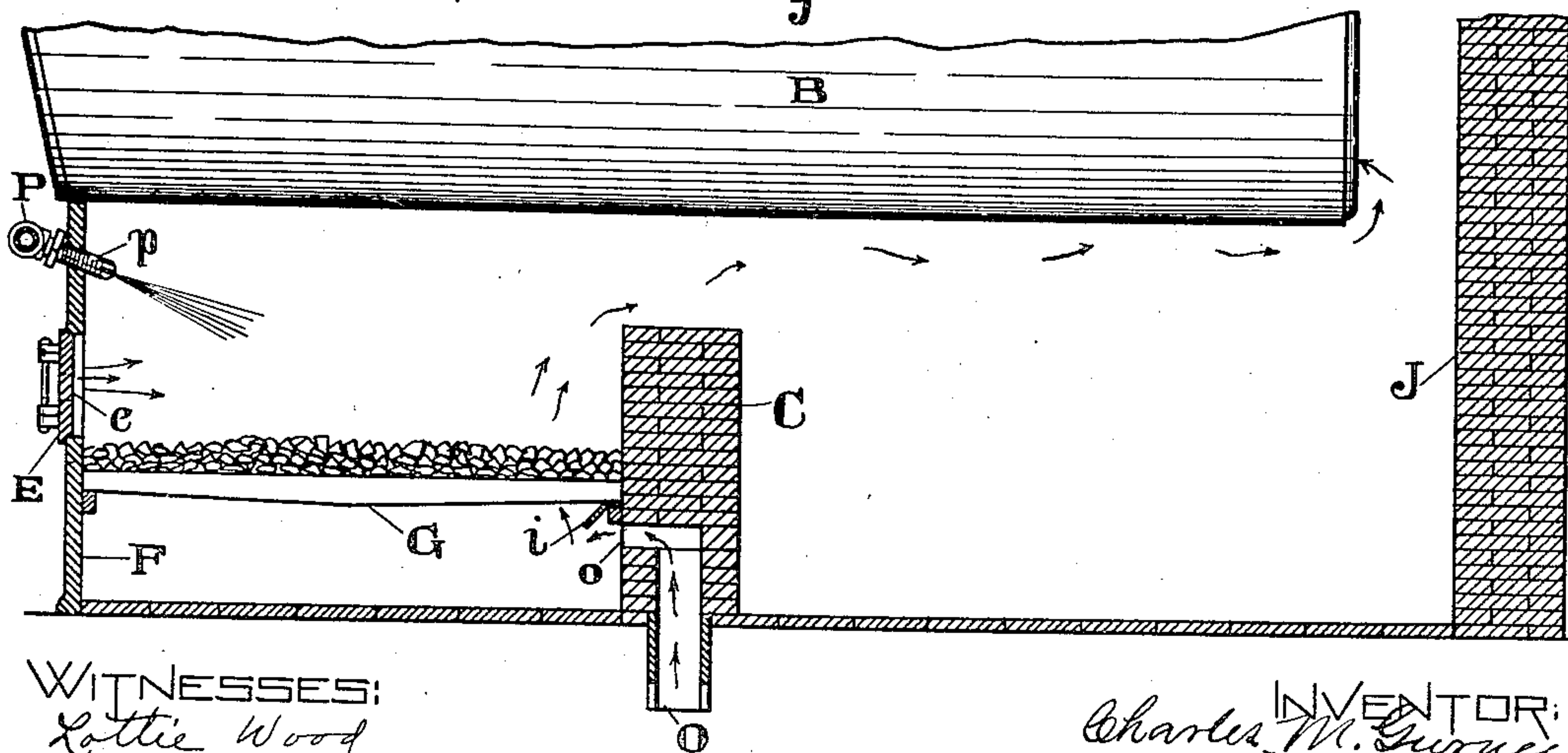


FIG. 2.



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ART OF BURNING FUEL IN FURNACES FOR BOILERS, &c.

No. 925,632.

Specification of Letters Patent.

Patented June 22, 1909.

Application filed December 20, 1906. Serial No. 348,766.

To all whom it may concern:

Be it known that I, CHARLES M. GURNEE, a citizen of the United States, and a resident of Rochester, in the county of Monroe and State of New York, have invented a new and useful Improvement in the Art of Burning Fuel in Furnaces for Boilers, &c., of which the following is a specification.

This invention relates to furnaces for boilers and other like uses, the object being to provide a construction and arrangement of the cooperating parts of the furnace and method of burning fuel therein which will result in a more efficient and economical consumption of the fuel, such as coal, which is adapted to hand stoking and which also, as to its essential features, may be secured by as few modifications as possible in ordinary furnaces as already constructed and equipped.

With these objects in view, my invention consists in providing and maintaining in a state of combustion, preferably at the rear of the furnace, a bed of distilled or coked fuel and, preferably at the front of the furnace, a bed of fresh fuel in a state of distillation, intermingling with the volatile products of such distillation a, preferably regulable, quantity of either air or steam or both air and steam, causing the volatile products of such distillation, commingled with air or steam or both, to pass over and in contact with the bed of coked fuel and restricting the supply of air to such coked fuel to that quantity barely sufficient to maintain complete combustion thereof, and it is also very desirable that such restricted quantity of air to the coked fuel be regulated automatically and responsively to the variations in the rate of the combustion thereof.

The accompanying drawings illustrating such a furnace are as follows:—

Figure 1 shows a front elevation of a furnace for a boiler setting in accordance with my invention with the front plate thereof removed to the right of the central vertical line. Fig. 2 shows a portion of the boiler and beneath it the furnace in a vertical section taken along the dotted lines $x-y$ of Fig. 1.

Similar letters refer to similar parts throughout the several views.

Referring to the drawings,—B is the boiler, J the brick work around the boiler, F is the front plate and E is one of the stoking doors having the regulable draft damper e

therein. P is a pipe leading from the dome of the boiler to the steam jets $p-p$. C is the bridge wall having the flue O therein terminating in the horizontally elongated orifice o underneath the rear end of the grate bars. A deflector i is arranged under the rear end of the grate bars and over the opening o to prevent ashes falling through the grate from sifting into the opening o . G is the grate of the usual construction. The portion of the flue O extending under the bridge wall may be formed of any suitable material, and it connects with the box A, having a part of the side toward the observer removed in Fig. 1 to show the internal arrangement. A single vane or damper a^1 is pivotally supported at the upper right hand corner of the box A. Arranged vertically and curved concentrically with the pivotal support for this damper a^1 is provided a grating a , one bar only of which is seen, and between which the air passes to the flue O, as indicated by the arrows.

The damper a^1 is arranged to fit snugly between the front and rear sides of the box A, so as to prevent the entrance of air thereto except over the top of such damper and between the bars of the grating a . There extends to the right from the pivotal support for this damper a^1 an arm a^3 through which there is threaded the rod a^2 having a handle at its upper end and a weight a^4 secured at its lower end whereby the weight a^4 may be raised or lowered as desired to oppose a correspondingly lesser or greater resistance to the downward movement of the damper a^1 . The weight a^4 is so adjusted, by means of the rod a^2 threaded through the arm a^3 , that the normal position of the damper a^1 is such as to admit air through the grating a and into the flue O in sufficient quantity only to supply oxygen enough to effect the perfect combustion of the coked coal at the rear end of the grate G where the normal tendency for the air to pass upwardly through the grate is greatest, the course of the air being indicated by arrows. The coked coal at the rear end of the grate is thus supplied with barely sufficient air to maintain a perfect combustion thereof. The fresh coal is placed upon the front end of the grate and as the same becomes gradually heated up, the gases distilled therefrom as they pass over the coked and more perfectly burning coal at the rear of the grate, intermingled with steam from

the jets p , are highly heated and the combustion thereof is rendered nearly or quite perfect; when desired, air may be supplied to such gases through the adjustable draft dampers e in the stoking doors E . When the more volatile gases have been distilled from the fresh coal at the front of the furnace and consumed in the manner just above described such coal may be forced to the rear and a new supply of fresh coal placed on the front of the grate. The amount of steam from the jets p may be regulated by means of the hand-controlled valve w in the pipe P , which should be so adjusted in connection with the draft dampers e as to supply to the gases distilled from the fresh coal at the front end of the grate only a sufficient quantity of steam and air to effect a perfect combustion of such gases as they become highly heated in passing over the coked fuel at the rear of the grate.

In connection with the above description and explanation of my invention, I desire to call attention to the following points, viz.:

It is a well known fact that an excessive supply of air or a forced draft through a furnace just after having been supplied with fresh coal results in imperfect combustion and a waste of fuel passing off up the chimney as smoke. To make use of a forced draft in connection with the steam jet often results in imperfect combustion and the issuance of smoke from the chimney, the color of which may be modified by the presence of steam and the amount of fuel lost through such imperfect combustion thereby concealed. In comparison with some of the above mentioned conditions and results, I will mention that in using my furnace I prefer that the draft to and through the coked and perfectly burning coal at the rear of the grate be both restricted to and produced by the demand for such fresh air, that is, restricted to such an extent that there is a very noticeable suction through the grating a , under which condition the most perfect and smokeless combustion of the coal or fuel in the furnace is maintained.

I have found it preferable to supply steam to the gases, as they are distilling from the freshly stoked coal, which may be mixed also with a small proportion of air, to effect the perfect combustion of such gases in passing over the coked fuel at the rear of the furnace. Steam should not be supplied in sufficient quantity to pass up the chimney as steam for the sake of changing the color of the smoke issued therefrom.

The weight a^1 may be adjusted by the handle a^2 so that the damper a^1 will close upon the admission of too much steam or air to the fire above the grate, thus affording a ready and visual indication of the draft conditions obtaining at the time. Again, the proper amount of steam or steam and air to be ad-

mitted above the grate can readily be determined by noting the behavior of the damper a^1 . Should the damper close, it indicates at once that there is too much steam or air or both being admitted above the grate.

What I claim is:—

1. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling air or steam with the volatile products of such distillation, causing the commingled air or steam and volatile products of such distillation to flow over and in close contact with the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively directly to variations in the rate of combustion thereof.

2. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling a regulable quantity of air or steam with the volatile products of such distillation, causing the commingled air or steam and volatile products of such distillation to flow over and in close contact with the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively directly to variations in the rate of combustion thereof.

3. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling air or steam with the volatile products of such distillation, subjecting the commingled air or steam and volatile products of such distillation to heat, to cause the combustion thereof, from the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively directly to variations in the rate of combustion thereof.

4. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling a regulable quantity of air or steam with the volatile products of such distillation, subjecting the commingled air or steam and volatile products of such distillation to

heat, to cause the combustion thereof, from the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively directly to variations in the rate of combustion thereof.

5. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling air or steam with the volatile products of such distillation, causing the commingled air or steam and volatile products of such distillation to flow over and in close contact with the bed of coked fuel and supplying to said bed of coked fuel an adjustably restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

6. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling a regulable quantity of air or steam with the volatile products of such distillation, causing the commingled air or steam and volatile products of such distillation to flow over and in close contact with the bed of coked fuel and supplying to said bed of coked fuel an adjustably restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

7. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling air or steam with the volatile products of such distillation, subjecting the commingled air or steam and volatile products of such distillation to heat, to cause the combustion thereof, from the bed of coked fuel and supplying to said bed of coked fuel an adjustably restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

8. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling a regulable quantity of air or steam with the volatile products of such distilla-

tion, subjecting the commingled air or steam and volatile products of such distillation to heat, to cause the combustion thereof, from the bed of coked fuel and supplying to said bed of coked fuel an adjustably restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

9. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling air or steam with the volatile products of such distillation, causing the commingled air or steam and volatile products of such distillation to flow over and in close contact with the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

10. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling a regulable quantity of air or steam with the volatile products of such distillation, causing the commingled air or steam and volatile products of such distillation to flow over and in close contact with the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

11. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling air or steam with the volatile products of such distillation, subjecting the commingled air or steam and volatile products of such distillation to heat, to cause the combustion thereof, from the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

12. The improvement in the art of burning coal or like fuel in a furnace which consists in providing and maintaining a bed of coked fuel in a state of combustion and a bed of green fuel in a state of distillation, intermingling a regulable quantity of air or steam

with the volatile products of such distillation, subjecting the commingled air or steam and volatile products of such distillation to heat, to cause the combustion thereof, from
5 the bed of coked fuel and supplying to said bed of coked fuel a restricted quantity of air barely sufficient for complete combustion thereof and automatically regulating the quantity of air supplied to said bed of coked fuel responsively to variations in the demand therefor.

CHARLES M. GURNEE.

Witnesses:

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LOTTIE WOOD.