FURNACE FOR PREVENTING SMOKE AND ECONOMIZING FUEL.

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E. OTT.

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FURNACE FOR PREVENTING SMOKE AND ECONOMIZING FUEL.


Application filed December 6, 1899. Serial No. 739,797. (No model.)

To all whom it may concern:

Be it known that I, EMIL OTT, a subject of the Emperor of Germany, residing at 11 Kurfürststrasse, Berlin, in the Empire of Germany, have invented certain new and useful Improvements in and Relating to Furnaces for the Prevention of Smoke and Economization of Fuel, of which the following is a specification.

This invention relates to a furnace in which for the purpose of generating water-gas steam is sent through the furnace-grates. In order to obviate the disadvantages attaching to the water-gas furnaces of this class as hitherto constructed—disadvantages mainly arising from the fact that by the admission of steam in "operative" or "effective" quantities the glow or heat existing upon the furnace-grates is unduly reduced, while at the same time a coking instead of a combustion of the fuel is brought about—the steam required for the production of water-gas is according to this invention conducted through the furnace-grates, together with a mixture of combustion-gases or smoke and fresh air. As the fresh air by mixing with the hot combustion-gases enables the gases to move through the furnace-chamber very rapidly without thereby causing the combustion to take place with a considerable surplus quantity of air, which would be unsatisfactory in the result, it becomes possible to introduce somewhat large quantities of steam into the furnace-chamber, though the proportion of moisture in the mixture of smoke and air be comparatively small, and inasmuch as part of the steam which is evolved during the combustion of the water-gas is, together with the combustion-gases, reintroduced over and over again into the furnace-chamber and as it passes through the layer of fuel is converted into water-gas the water-gas production is greatly facilitated and the resulting useful effect turns out to be extremely profitable.

In the accompanying drawings a furnace constructed in accordance with this invention is represented as being applied to a tubular boiler and to a flame-tube boiler.

Figures 1 to 3 relate to the tubular-boiler furnace and Figs. 4 to 6 to the flame-tube boiler-furnace. Fig. 1 is a vertical longitudinal section. Fig. 2 is a horizontal section. Fig. 3 is a vertical cross-section. Fig. 4 is a vertical longitudinal section of a flame-tube boiler fitted with the improved furnace. Fig. 5 is a horizontal cross-section with the flame tubes or flues in elevation; and Fig. 6 is a vertical cross-section on line 6, Fig. 5.

In Figs. 1 to 3, relating to the tubular-boiler furnace, as stated, a designates the fire-grate. b is the furnace-chamber. c is the steam-boiler, the tubes of which as far as is desirable may be built around with tiles or brickwork. d is the draft-flue or chimney. e is the ash-box, which is connected with the 65 channel or flue f, serving for the escape of the fire-gases. g is a screw blast or fan which, as indicated diagrammatically, is driven by an engine h. Into the space i, which forms the connection between the ash-box e and the 70 fire-gases escape-flue f, there open air channels or ports k, through which fresh air for supporting combustion is admitted. The fire-bridge l is provided with recesses m and through these establishes direct communication between the ash-box e and the furnace-chamber d. The said recesses or hollow spaces m of the fire-bridge open toward the ash-box and communicate therewith through two pipe-shaped ports n, while toward the 80 furnace-chamber they terminate in slots o.

In the fire-gas outlet toward the chimney there is provided an adjustable damper p, while the width of the channel or passage through which the fire-gases are conducted to 85 the ash-box may be varied by means of an adjustable valve or door q. A pipe r, which extends into the ash-box and is provided with perforations at the part inclosed within such ash-box, serves to admit water or steam for the production of water-gas.

The method of operation of the furnace is as follows: Upon the grate a fuel is burned in the usual way. When the screw-blast g is set in rotary motion, with the dampers or valve-95 doors p and q wholly or partly open, the combustion-gases will in part escape through the chimney or flue d, while portions of them will be drawn into the ash-box e by the suction of the screw blast or fan. Together with the combustion-gases the screw-fan will draw in air through the air-inlets k, which air upon encountering the fire-gases in the space or chamber f will mix with such gases, so
that a close mixture of fire-gases and air will be forced into the ash-box c by the said screw fan or blast. This mixture of gases and air before it passes through the interstices of the grate and as it comes in contact with the water or steam issuing through the perforations of the plate f and takes up a certain amount of steam, which upon touching the red-hot fuel is decomposed and causes water-gas to be generated. Through the admixture of fire-gases to the fresh air admitted to support combustion such air is intensely heated, whereby the production of water-gas is facilitated, while the air, on the other hand, cools down the combustion-gases and by so doing prevents the screw-fan drawing in the gases from being injuriously affected by an unduly-raised temperature. The water-gas is burned in the furnace-chamber, water being at the same time separated in the form of steam. The steam as evolved is carried off, together with the fire-gases, so that these gases when they find their way under the grate upon having been mixed with fresh air already contain a substantial proportion of steam and therefore need absorb but little water when they come in contact with the steam issuing from the pipe r. By the proper adjustment of the damper p and the valve or door q the quantity of mixture of smoke and air forced into the ash-box by the screw-blast may be regulated as will. By converting this furnace into a partial gas-furnace a flame of far greater length and more intense heat and a proportional increase in the useful effect or working capacity of the furnace as compared with an ordinary coal-furnace will be secured, besides the permanent filling of the furnace-chamber with a gas burning with a flame affords the possibility of almost entirely burning the minute particles of coal which otherwise, and especially at the time of re-filling the furnace with fuel, would escape in the form of black smoke. Hence the furnace operates not only economically but practically without smoke. A portion of the mixture of combustion-gases and air forced into the ash-chamber by the screw-blast enters the hollow fire-bridge through the pipes s without passing through the grate-bar spaces and then passes through the slots in the upper part of the said bridge, it being optional to provide one connected slot instead of a series, and enters the fire-chamber in the direction opposite to that in which the combustion-gases escape, and as at this stage a portion of the particles of coal suspended in the said fire-chamber is burned it will be seen that this arrangement assists perfect combustion and helps to insure greater freedom from smoke.

The furnace represented in Figs. 4 to 6 as being applied to a fire-tube boiler in no way differs from the tubular boiler furnace just described in as far as its operation is concerned. Instead of a single fire-chamber two such chambers b are provided in this case, they being formed by the fire tubes or flues of the boiler. The grates c are within these tubes or flues. The screw blast or fan g, which serves to draw in the fire-gases and the air required to promote combustion and which is driven by a motor-engine h, is arranged within the fire-gas escape flue or chimney f. In front of the inlet orifice of this escape flue there is built a box or chamber s, which serves to connect the said flue with the ash box or boxes e, as the case may be. The pipes r serve to admit water or steam into the said ash-boxes e. Air holes or ports k admit fresh air to maintain combustion into the fire-gas-escape flue f or into the mixing-chamber behind the screw-fan g, as the case may be. By the hollow fire-bridge l a direct communication is established between the ash-chamber e and the furnace-chamber b. A damper p enables the volumes of gases flowing toward the flue or chimney d to be suitably controlled.

In practice while the furnace is in use the fire-gases, as usual in flame-tube boilers, flow toward the chimney in the direction of the arrows. When the screw-fan g is in operation, it will attract by suction a portion of the gases and force them after they have mixed with the air drawn in at the same time through the channels k through the interior of the box s into the ash-boxes e. Here the mixture of smoke and air as it comes in contact with the steam discharged from the pipes r takes up a certain amount of water. The mixture of air and gases thus charged with steam then passes through the interstices of the grate and penetrates the layer of red-hot fuel, at which juncture the steam becomes dissociated and water-gas is produced. In the furnace-chamber the water-gas is burned and re-forms steam during its combustion, which steam is carried off by the fire-gases preparatory to being readmitted under the grate and partly escaping through the chimney. The mixture of gases and air admitted through the hollow fire-bridge direct into the furnace assists a more perfect combustion of smoke in the same manner as has been stated in reference to the tubular boiler.

The furnace hereinafore described may be variously modified without any departure from the principle of the invention. For example, instead of charging the mixture of gas and air itself with steam immediately before its passage through the grate-spaces an opportunity may be afforded to the constituents of such mixture—i.e., to the combustion-gases on the one hand and to the fresh air used in keeping up combustion on the other—to absorb adequate quantities of steam separately or before they become mixed; also, it would suffice to mix water in a finely-divided condition, either with the fire-gases alone or only with the air used to support combustion. The arrangement exemplified in the drawings, however, has proved to be particularly advantageous. Again, instead of drawing in
the fire-gases at so early a stage as that at which they flow toward the chimney-flue they may first be allowed to enter such flue, though the comparative disadvantage which this method would entail lies in the fact that more powerful suction would in that case be necessary.

What I claim is—

1. In a furnace, the combination of a chamber connecting the ash-pit and the channel which leads the fire-gases to the chimney, air-pipes opening into that chamber, a fan in that chamber adapted to draw fire-gases and fresh air into that chamber and to force the mixture of same into the ash-pit, a water-pipe located in the ash-pit provided with holes adapted to distribute water in a finely-divided state, substantially as set forth.

2. In a furnace, the combination of a chamber connecting the ash-pit and the channel which leads the fire-gases to the chimney, air-pipes opening into that chamber, a fan in that chamber adapted to draw fire-gases and fresh air into that chamber and to force the mixture of same into the ash-pit, a water-pipe located in the ash-pit provided with holes adapted to distribute water in a finely-divided state, substantially as set forth.

3. In a new and improved furnace for flue-tube boilers the combination with fire-grates in the flue-tubes, of a casing opening into the ash-pit below said fire-grates, a conduit connecting the interior of said casing with the channel leading the fire-gases to the smoke-flue, a fan in that conduit adapted to draw fire-gases and fresh air through said casing, ash-pits and fire-grates and means to mix or combine said gases and air with water in a finely-divided state before entering the grate, substantially as set forth.

Signed this 25th day of November, 1899, at Berlin, Germany.

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