(No Model.) 2 Sheets—Sheet 1.

E. HERRMANN & L. P. COHEN.

FURNACE.

No. 385,623. Patented July 3, 1888.

Fig. 1.

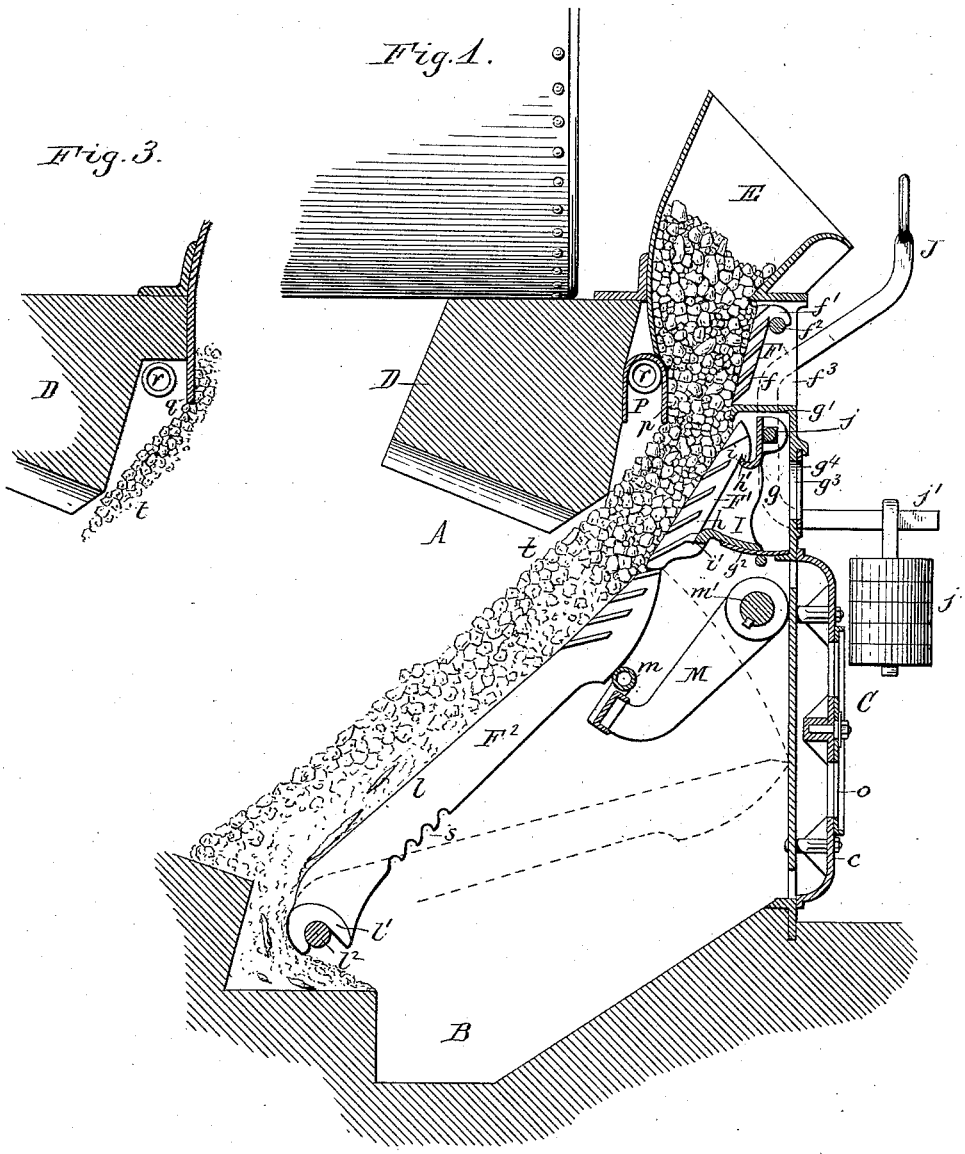

Fig. 3.

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(No Model.) 2 Sheets—Sheet 2.

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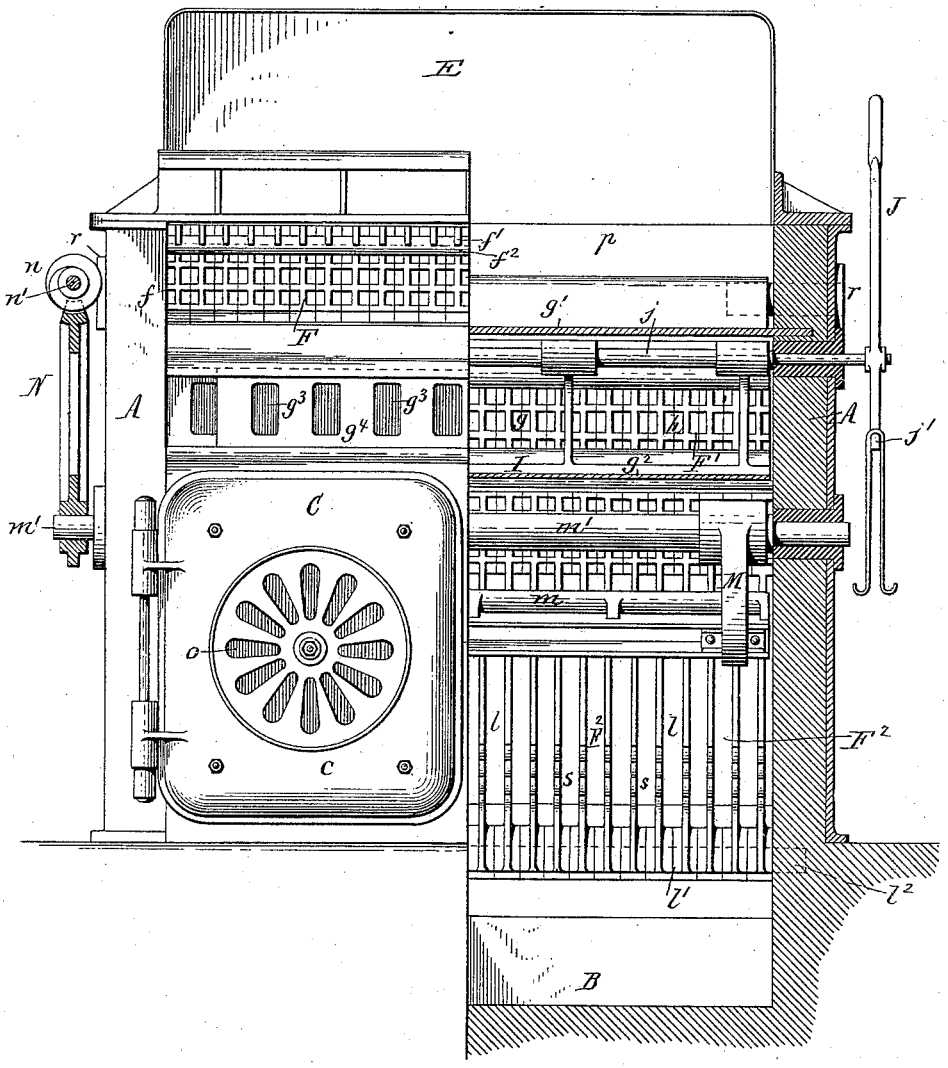
Fig. 2.



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UNITED STATES PATENT OFFICE.

ERNEST HERRMANN AND LOUIS PHILIPP COHEN, OF PARIS, FRANCE.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 385,623, dated July 3, 1888.

Application filed September 10, 1887. Serial No. 249,299. (No model.) Patented in France December 24, 1886, No. 180,480.

To all whom it may concern:

Be it known that we, ERNEST HERRMANN, a citizen of France, residing at Paris, and LOUIS PHILIPP COHEN, a citizen of the German Empire, residing at Paris, France, have invented a new and useful Improvement in Furnaces, (for which we have obtained a patent in France, No. 180,480, bearing date December 24, 1886,) of which the following is a specification.

This invention relates to an improvement in steam-boiler furnaces, and more particularly to a furnace in which an inclined grate is employed which is composed of several movable sections.

It is well known that in order to consume the combustible gases generated by the distillation of coal, especially the double carbureted hydrogen gas, which is largely generated by the distillation of coal on a furnace-grate, it is not only necessary to provide the requisite volume of air and a sufficiently-high temperature, but it is also necessary to prevent the accumulation of the gas in large bodies or volumes, which renders it impossible to burn the gas completely and causes a considerable waste of fuel.

The object of our invention is to thoroughly commingle air with the combustible gases as soon as they are generated, thereby causing the gas to be burned before a large volume of the gas can accumulate.

Our invention consists to that end of the improvement in the construction of the furnace which will be hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, consisting of two sheets, Figure 1 is a longitudinal sectional elevation of a steam-boiler furnace provided with our improvements. Fig. 2 is partly a front elevation thereof and partly a cross-section. Fig. 3 is a longitudinal vertical section showing a modified construction of the air-inlet above the grate.

Like letters of reference refer to like parts in the several figures.

A represents the side walls of the furnace; B, the ash-pit; C, the furnace-front; *c*, the ash-pit doors, and D the arch forming part of the roof of the fire-chamber.

E represents the fuel hopper or receptacle arranged above the upper end of the grate and supplying the fuel thereto. The inclined grate extends from the hopper E downwardly to within a short distance from the bottom of the ash-pit, and is composed of three sections, F F′ F². The upper section, F, forms the lower front wall of the fuel-hopper E, and consists of a series of grate-bars, *f*. The latter are provided at their upper ends with hooks *f*′, which engage over a horizontal supporting-rod, *f*², secured with its ends in the side walls, A. This upper section, F, serves not only to admit air to the fuel, but also as a means of observing the flow of fuel to the furnace, and enables obstructions in the throat of the hopper to be readily removed. This upper section, F, is arranged in an opening, *f*³, formed in the upper portion of the furnace-front. The intermediate section, F′, of the grate is arranged in a chamber, *g*, formed in the furnace-front C below the opening *f*³, and separated therefrom by a horizontal plate, *g*′. The section F′ is composed of a series of grate-bars, *h*, which are provided at their upper ends with hooks *h*′, by which the bars are supported on the upper ledge, *i*, of a pendent supporting-frame, I, the lower ends of the bars resting against the lower ledge, *i*′, of said frame. The latter is mounted upon a horizontal rock-shaft, *j*, which is journaled in suitable bearings in the side walls of the furnace-front.

J represents a hand-lever secured to the outer end of the rock-shaft *j*, and whereby the latter is oscillated to shake the grate-section F′. The lever J is provided at its lower end with an arm, *j*′, to which is attached a counterbalancing-weight, *j*², which holds the section F′ in its normal position when released, and prevents the same from being moved outwardly by the weight of the fuel resting thereon.

The chamber *g* is provided with a bottom plate, *g*², which is curved concentric with the rock-shaft *j*. The bottom cross-piece of the pendent frame I is similarly curved and swings closely above the curved plate *g*², to prevent access of air to the grate-section F′, except through the openings *g*³ in the front wall of the chamber *g*, which openings are controlled by a slide, *g*⁴.

The lower grate-section, F², is composed of a series of grate-bars, *l*, which are supported at their lower ends by hooks *l*′ upon a hori-

zontal bar, l^2, secured transversely in the ash-pit. *m* represents a transverse rail or bar arranged underneath the upper portions of the grate-bars *l*, and supporting the upper front ends of the latter. The rail *m* is secured to the lower ends of arms M, which are secured to a transverse rock-shaft, *m'*, so that by turning the shaft *m'* forwardly the upper ends of the grate-bars will be allowed to descend by gravity and assume the position indicated by dotted lines in Fig. 1, while by moving the shaft in the opposite direction the grate-bars will be raised to the position shown by full lines in the same figure. This construction enables the thickness of the layer of fuel to be regulated by raising or lowering the grate, and also permits the same to be cleaned and the material to be placed on the grate for starting the fire.

N represents a toothed segment secured to the outer end of the rock-shaft *m'*, and meshing with a worm, *n*, so that by turning the latter in one or the other direction the grate-bars *l* will be raised or lowered. The worm *n* is mounted upon a horizontal shaft, *n'*, which is provided with a suitable handle for turning it.

o represents dampers or registers arranged in the furnace-doors *c*, for regulating the admission of air to the lower grate-section, F^2.

P represents an air-passage, whereby air is admitted to the upper portion of the fuel-space above the grate. This air-passage is formed between the rear wall of the fuel-hopper E and the front side of the arch D. As shown in Figs. 1 and 2, the air-passage is composed of an inverted channel-bar or trough, *p*, which extends across the entire length of the grate and deflects the air downwardly upon the fuel resting on the grate.

In the modified construction shown in Fig. 3 the arch D is provided with an overhanging portion, *q*, against which the rear wall of the fuel-hopper is fitted and whereby the air-passage is formed.

The air-passage P is supplied with air at both ends by pipes *r*, which extend through the side walls, A, of the furnace.

When the fire has been started in the furnace, the hopper E is charged with fuel, which latter descends and passes successively over the grate-sections F F' F^2. The fuel resting upon the lower grate section burns brightly while the fuel resting upon the upper grate-sections is being distilled, thereby generating carbureted-hydrogen gas, which latter follows the course of the draft downwardly and passes through the burning layer of fuel. A suitable volume of fresh air is drawn through the air-pipes *r* and passage P and mixed with the combustible gas which is generated upon the upper grate-sections. The gas unites with the oxygen of the air when this mixture passes over the burning fuel on the lower grate-section, and in this manner a complete combustion of the gas is secured. After the preliminary distillation and combustion has advanced sufficiently on the intermediate grate-section, F', which can be observed through the openings of the intermediate section, F', the fuel is caused to descend to the lower section, F^2, by shaking the grate, where such a perfect combustion of the fuel is effected that a deposit of slags or cinders is formed only upon the lowermost part of the grate F^2. This slag formation is, however, very small in quantity, being only a fifth part of the residue which would remain by burning the same amount of fuel on an ordinary horizontal grate.

The grate-bars of the lower section, F^2, are preferably provided with notches *s*, in which a bar can be inserted for shaking each bar separately when required for dislodging clinkers or other purposes.

The intermediate grate-section, F', forms a movable jaw, which constitutes a continuation of the mouth of the fuel-hopper, the opposite jaw being formed by the arch D.

The products of the distillation of the coal on the grate-section F', both solid and gaseous, pass downwardly, mixed with fresh air, through the throat *t*, between the grate-section F' and the arch D, and enter the fire-chamber in the proper condition for a complete and smokeless combustion.

Our improved furnace effects the combustion with a minimum quantity of air, prevents the influx and cooling effect of excessive quantities of air, and reduces the loss of heat correspondingly.

Our improved furnace has the further advantage that any kind of coal may be burned in the same, as the gases of those kinds of coal which prevent the passage of air are supplied with air by the air-passage above the grate.

We claim as our invention—

1. The combination, with the furnace-front C and the fuel-hopper E, mounted thereon, of the transverse plates g' g^2, secured to the front C, one above the other, the upper grate-section, F, arranged between the fuel-hopper and the plate g', the intermediate grate-section, F', arranged between the plates g' and g^2, the lower grate-section, F^2, arranged below the plate g^2, the arch D, arranged opposite the intermediate grate-section, F', and the air-inlet P, arranged below the fuel-hopper and above the throat of the arch, substantially as set forth.

2. The combination, with the fuel-hopper E, the upper grate-section, F, and the lower grate-section, F^2, of the grate-section F', composed of bars *h*, and an open frame, I, a rock-shaft, *j*, supporting said frame, and a hand-lever, J, attached to said rock-shaft, substantially as set forth.

3. The combination, with the fuel-hopper E, the upper grate-section, F, and the grate-section F', of the lower grate-section, F^2, composed of bars *l*, a fixed cross-bar, l^2, supporting the lower ends of said bars, and a movable cross-bar, *m*, supporting the upper ends of said bars, substantially as set forth.

4. The combination, with the grate-sections

F F′ and the bars *l* of the lower grate-section, of the fixed cross-bar l^2, supporting the lower ends of said bars, the movable cross-bar *m*, supporting the upper ends of said bars, arms M, carrying the cross-bar *m*, a rock-shaft, *m′*, to which the arms M are secured, and gears whereby said rock-shaft can be turned, thereby changing the inclination of the grate-bars *l*, substantially as set forth.

5. The combination, with the furnace-front C, provided with a chamber, *g*, open at its front and rear sides, of the upper grate-section, F, the grate-section F′, attached to a frame, I, in the chamber *g*, a curved plate, g^2, forming the bottom of said chamber and fitting against the lower side of the frame I, and the lower grate-section, F^2, arranged below the chamber *g*, substantially as set forth.

Witness our hands this 24th day of August, 1887.

ERNEST HERRMANN.
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Witnesses:
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