No. 690,432. Patented Jan. 7, 1902.

E. M. HUGENTOBLER.

FURNACE FOR BURNING BITUMINOUS COAL.

(Application filed May 10, 1901.)

(No Model.) 2 Sheets—Sheet 1.

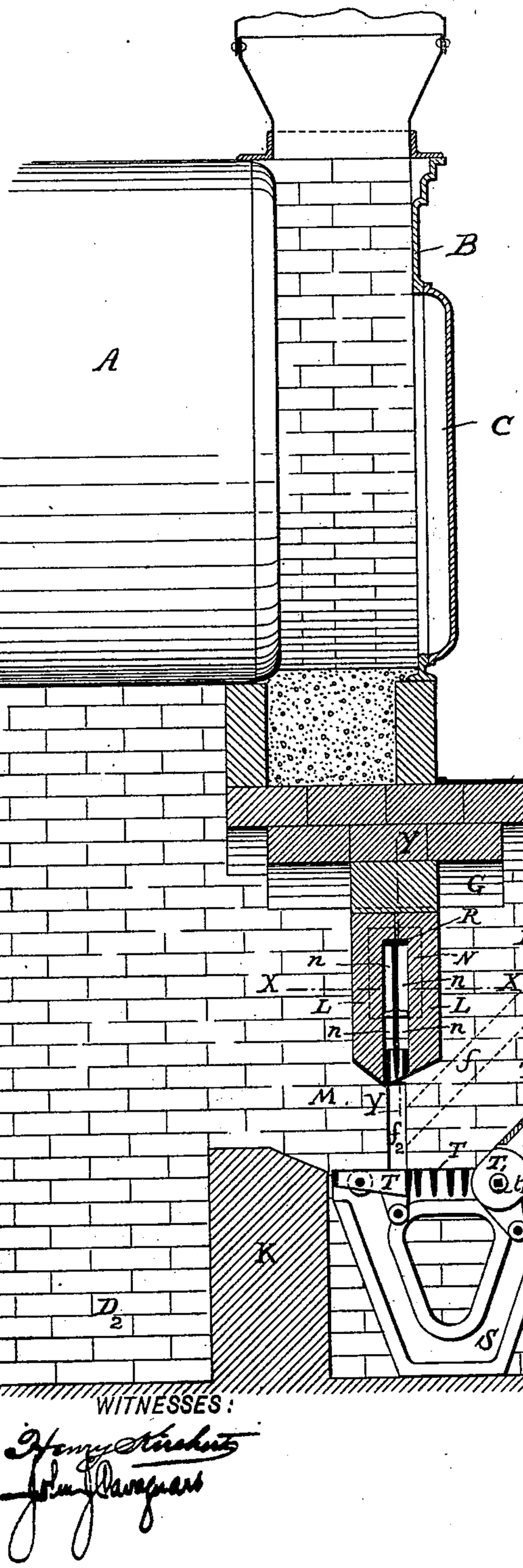

Fig. 1.

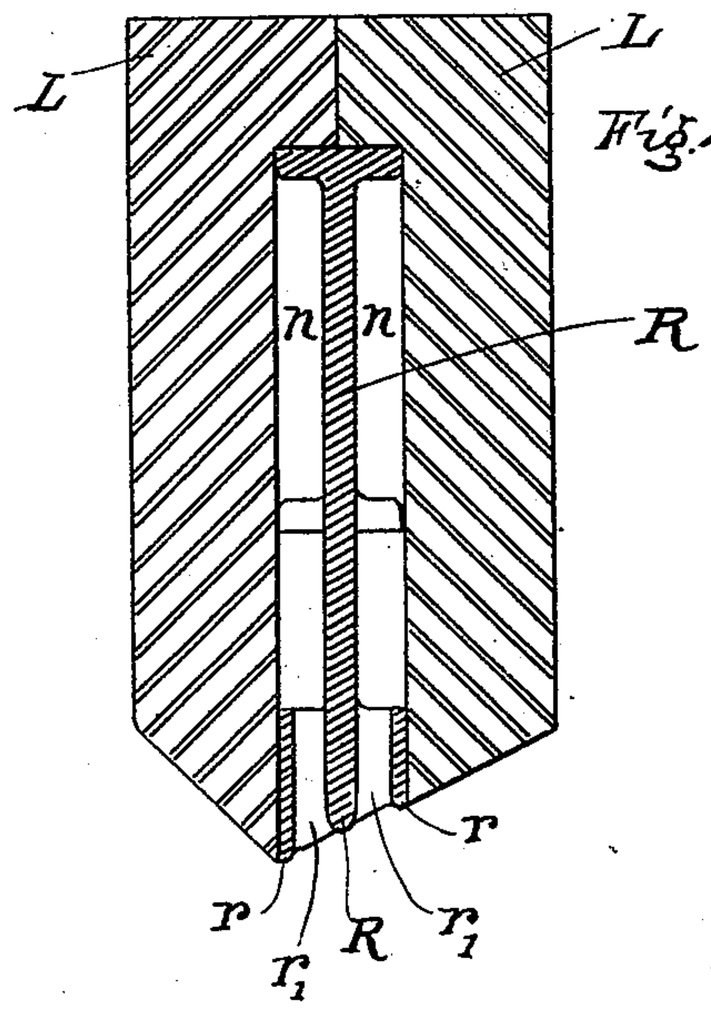

Fig. 4.

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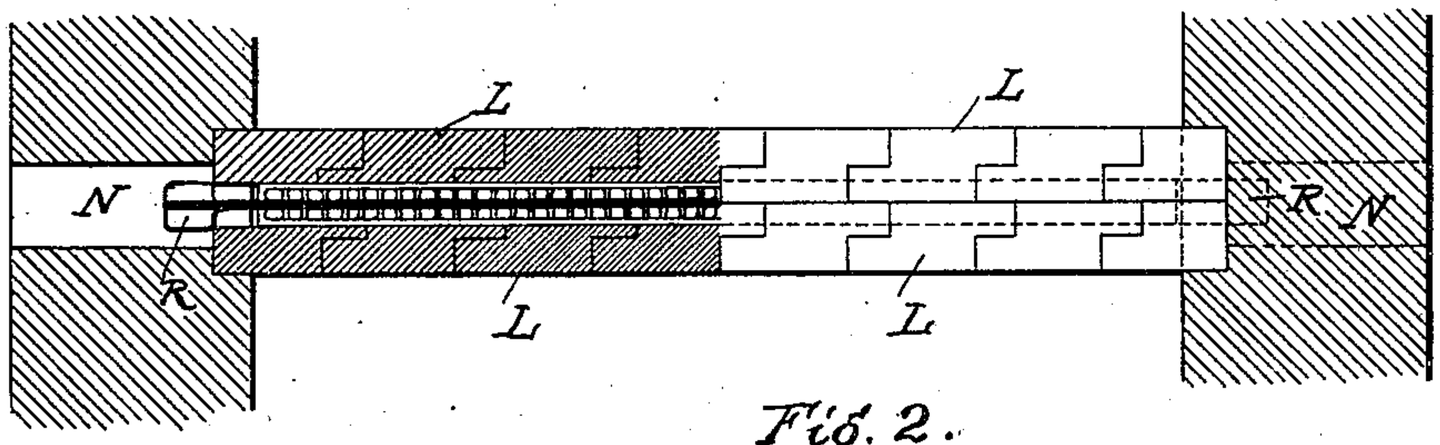

Fig. 2.

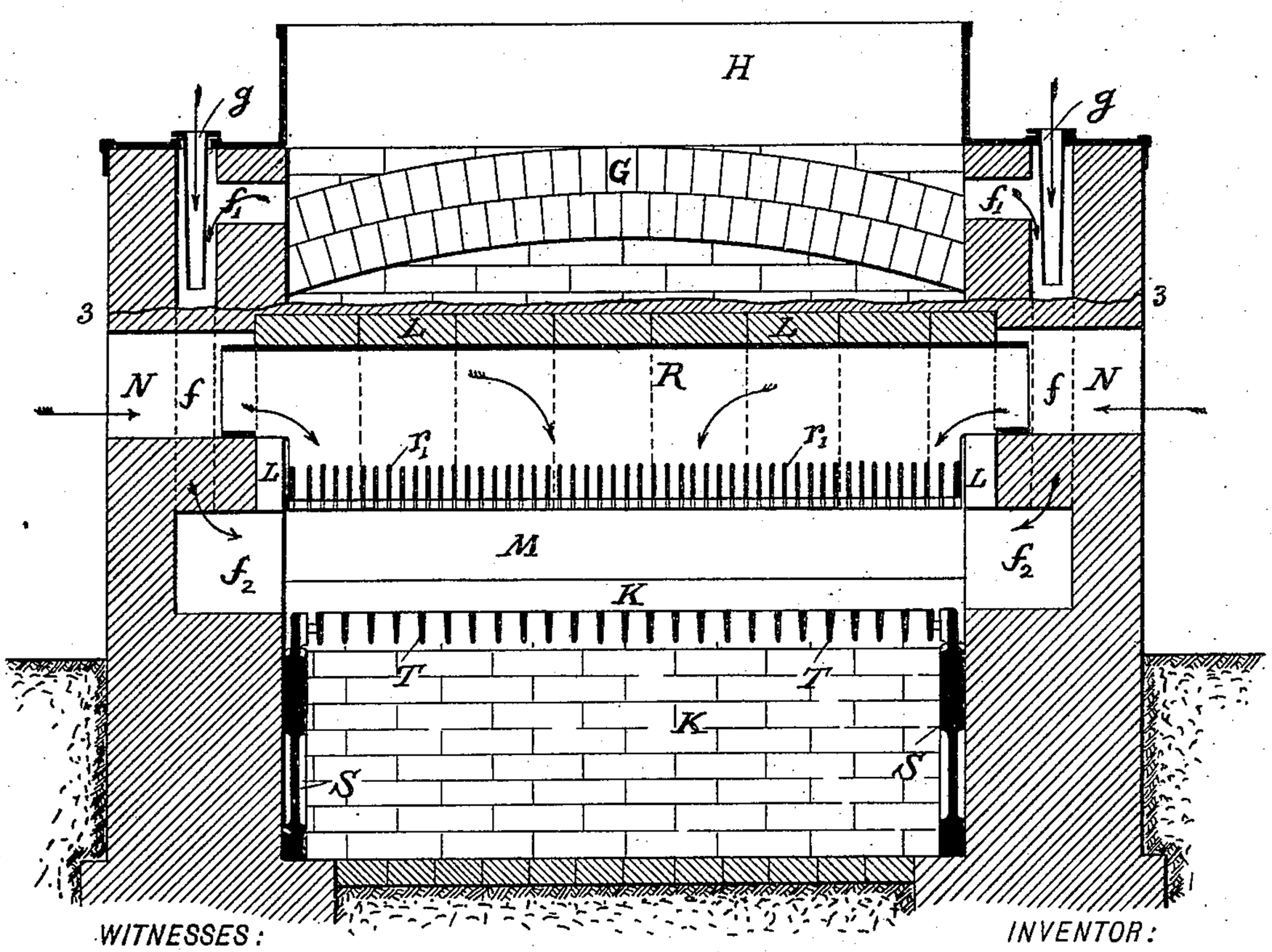

Fig. 3.

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UNITED STATES PATENT OFFICE.

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FURNACE FOR BURNING BITUMINOUS COAL.

SPECIFICATION forming part of Letters Patent No. 690,432, dated January 7, 1902.

Application filed May 10, 1901. Serial No. 59,636. (No model.)

To all whom it may concern:

Be it known that I, EMIL M. HUGENTOBLER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Furnaces for Burning Bituminous Coals; 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 appertains to make and use the same.

My invention relates to improvements in furnaces for burning bituminous coals, in which the thorough and complete combustion of all the combustible components of such coals is aimed at, including the volatile as well as the solid constituents.

In the furnace to which this improvement particularly relates the distillation and separation of the volatile products and the coking of the fuel are effected in a distinct and separate part of the furnace from that in which the combustion takes place, said volatile products being afterward led through the bed of incandescent fuel intermingled with a due proportion of air, whereby their complete combustion is effected.

The object of the present improvement is to still further perfect the means for securing the proper admission of air to that part of the furnace in which combustion takes place, so that the air has access to the burning mass on all sides thereof, and also to effect the complete aeration of the volatile components of the fuel introduced into the combustion-chamber.

In the accompanying drawings, forming a part of this specification, Figure 1 is a longitudinal sectional elevation through the axis of the furnace, showing in position for purposes of illustration the front end of a horizontal return tubular boiler attached thereto. Fig. 2 is a horizontal section, one half through the top of the arch-blocks and the other half through the plane X X, Fig. 1. Fig. 3 is a vertical transverse section through the plane Z Z, Fig. 1, in its upper portion and through the plane Y Y in the portion below broken line 3 3. Fig. 4 is a cross-section, on an enlarged scale, of the inverted bridge-wall and its supporting-beam.

A is a horizontal return tubular boiler. Its front B instead of reaching to the ground and being provided with fire-doors and ash-pit doors, as for an ordinary setting, is stopped off below the cleaning-door C at about the level of the bottom of the shell.

D is the furnace, located below and in front of the boiler. It is provided with an opening H on top for feeding in the fuel, an opening with door at E for kindling purposes, kept closed while the furnace is in operation, and an opening at I for admitting air to the combustion-chamber by way of the ash-pit D′, located beneath the grates.

G is an arch forming in part the top of the furnace, and beneath it is the inverted bridge-wall, formed of the matched refractory blocks L.

K is the ordinary bridge-wall at the rear of ash-pit D′, and between it and the inverted bridge-wall is a gap or fire-outlet M, which forms the only communication between the furnace and the boiler-setting. At the rear of bridge-wall K is the fire-chamber D^2, and in front of ash-pit D′ is the sloped entrance-way D^3 for convenience in removing ashes, covered with removable grating *i*, through which air is admitted to the combustion-chamber.

The blocks L, made of fire-clay or other suitable refractory material, are supported in position by being strung on a horizontal metallic beam R, as shown in Fig. 4, which is composed of a main web with a T-shaped head, carrying at the bottom on each side continuous side strips *r* by means of intervening ribs *r*′, having passages between them for the transmission of air. The beam R rests at its ends upon the side walls of the setting, and openings N are provided through these walls where the beams rest. When the blocks L are in place on the beam, channels *n* are left on each side of the web of the beam between it and the blocks, which channels are continuous with the openings N and with the passages between the ribs *r*′, so that air can flow uninterruptedly from the outside atmosphere directly into the gap or fire-outlet M downward from the center of the inverted bridge-wall. This flow of air serves also to keep the metallic beam R measurably cool, being oth-

erwise protected from the intense heat of the furnace by the refractory bridgework L.

S S are the grate-supports, located at the sides of the furnace against its side walls. In front of the bridge-wall K is the horizontal grate T beneath the combustion-chamber, a portion of which to the left is shown pivoted to serve as a dumping-grate, the remainder being shown stationary. Of course the whole might be pivoted. The dumping is accomplished by the ordinary lever attachments, which for the sake of clearness are omitted from the drawings. In front of grate T and adjacent thereto is an inclined pivoted rocking grate T′, formed of a series of toothed segments strung upon a pivoted rocking shaft t', capable of being oscillated by the usual lever appliances. The function of this rocking grate is to force the fuel forward into the horizontal combustion-chamber as it is fed downward. The means for rocking the grate T′ are the usual ones, omitted for the sake of perspicuity. Both grates T and T′ have ample air spaces or openings through them, to which air has free access through opening I and ash-pit D′.

Directly above and adjacent to grate T′ is the inclined fuel-support T^2. This is imperforate, so that no air can reach the fuel resting thereon. It forms a portion of the front wall of the fuel-chamber, whose rear wall is the inverted bridge-wall, before described. The lowermost plate of this fuel-support is serrated to admit of the passage of the teeth t^2, which project beyond the other serrations of rocking grate T^2 and which agitate the fuel at the intersection and prevent its caking at that point. An opening E, closed by a door, is provided at the top of the inclined fuel-support to admit of kindling and starting the fire at the base of the fuel-supply. Above the said door is the vertical front wall F of the fuel-chamber. The fuel in this case is supplied through an opening H in the top, which preferably has a funnel-shaped chute or hopper thereon, as shown in Fig. 1. The fuel in this hopper ordinarily closes the fuel in the fuel-chamber against the entrance of air in sufficient quantity to promote combustion.

While air, therefore, is practically excluded from the fuel in the fuel-supply chamber down to a plane passing through the lower edge of the fuel-support and the lower front edge of the inverted bridge-wall, it has free access to the fuel in the horizontal and rearwardly-extending passage adjacent to said supply-chamber, not only through grates T T′, but also through the passages N n, before mentioned, and through side passages or flues f, formed in the side walls, ports f^2, and twyers g, projecting downward into said passages f. The portion of fuel in the passage extending from grate T′ to and into gap or fire-outlet M is thus copiously supplied with air on all sides—*i. e.*, above, below, at the sides, and at the front—and forms in consequence a combustion-chamber in which the fuel is maintained in an intense state of combustion, while the fuel above said passage, to which the air-supply does not penetrate, does not burn, although being exposed to the heat of the burning fuel in the adjacent passage both by radiation and convection it is rapidly and thoroughly coked, the volatile components thereof tending to fill the chamber and some escaping into the combustion-passage by percolation downward. To provide for the thorough and complete combustion of this volatile product, which is highly combustible, side ports f' are provided in the walls, communicating with the upper space of the fuel-supply chamber, whereby they conduct said volatile products into the passages f, through which a strong current of air flows from the inserted twyers g, induced by the draft of air flowing through the bed of incandescent fuel in the combustion-passage by way of grates T T′, thus thoroughly aerating said volatile products, while providing for their complete combustion by passing them bodily through the incandescent mass of fuel. No volatile products can escape this passage through the burning mass, since the fuel-supply is always above the lowermost edge of the inverted bridge-wall.

I do not limit myself to the ports f' and side passages f and ports f^2 as a means of passing the volatile products through the incandescent mass, since it is evident that said products may be conveyed so as to emerge elsewhere than at the sides of the combustion-passage through ports f^2—namely, by way of passages terminating at the entrance or at the bottom of the combustion-passage, as shown in a copending application, or at the top through passages n n. The current of volatile products may, in fact, be discharged at any point where it will effectually join the incoming draft current or currents of air passing through the combustion-passage, so as to mingle with and be carried into the incandescent mass by said currents.

I claim and desire to secure by Letters Patent—

1. In a furnace for burning bituminous coal, a fuel-supply chamber, a combustion-passage adjacent thereto, means for mechanically forcing the fuel from the fuel-supply chamber into said combustion-passage, and means for passing air freely through said combustion-passage while excluding it from the fuel-supply chamber, by approaches or passages entering said combustion-passage at the front, the sides, the bottom, and the top thereof, substantially as specified.

2. In a furnace for burning bituminous coal, a fuel-supply chamber, an inverted bridge-wall at the rear thereof, openings for feeding and for kindling the fuel in said chamber, a combustion-passage laterally adjacent to said fuel-supply chamber, beneath said inverted bridge-wall, passages for leading the volatile products distilled from the fuel, from the

fuel-chamber to said combustion-passage, and means for supplying air freely to said combustion-passage at the front, sides, bottom, and top thereof, substantially as specified.

3. In a furnace for burning bituminous coal, a fuel-supply chamber, an inverted bridge-wall at the rear thereof, a combustion-passage beneath said inverted bridge-wall, adjacent to said fuel-supply chamber, air-passages communicating with the external air in said inverted bridge-wall and opening downward into said combustion-passage, air-passages *f* opening into said combustion-passage at the sides thereof, ports leading from the fuel-supply chamber into said air-passages *f*, and means for freely introducing air into said combustion-passage at the front and bottom thereof, substantially as specified.

4. In a furnace for burning bituminous coal, a fuel-supply chamber, an inverted bridge-wall at the rear thereof, a combustion-passage beneath said bridge-wall, means for mechanically forcing the fuel from the fuel-supply chamber into said combustion-passage, means for feeding air freely into said combustion-passage through the sides, bottom, and front thereof, and passages in said inverted bridge-wall for feeding air directly downward on top of the fuel in said combustion-passage, substantially as specified.

5. In a furnace for burning bituminous coal, an inverted bridge-wall, formed of refactory blocks horizontally arranged, a metallic bearing-beam for supporting said blocks, inclosed by the same, air-passages *n* between said blocks and said beam, air-passages N through the walls of the furnace communicating with said passages *n*, and webs *r'* at the lower edge of the bearing-beam forming air-passages between them leading from air-passages *n* directly downward, substantially as specified.

6. In a furnace for burning bituminous coal, a fuel-supply chamber, a feed-opening at top thereof, an inverted bridge-wall at rear thereof, an inclined imperforate fuel-support at front thereof, a lateral combustion-passage at bottom thereof, passing under said bridge-wall, an inclined rocking grate at front of said combustion-passage, a horizontal grate beneath said combustion-passage, a bridge-wall at the rear of said passage, forming a fire-outlet gap between said bridge-wall and the inverted bridge-wall, air-passages in the inverted bridge-wall, opening downward into the combustion-passage, air-passages in the side walls opening into the sides of the combustion-passage, and gas-ports opening from the fuel-supply chamber into said side air-passages, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

EMIL M. HUGENTOBLER.

Witnesses:
H. R. MACKAY,
H. W. HOLLY, Jr.