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W. A. KÖNEMAN.

SMOKE PREVENTING FURNACE.

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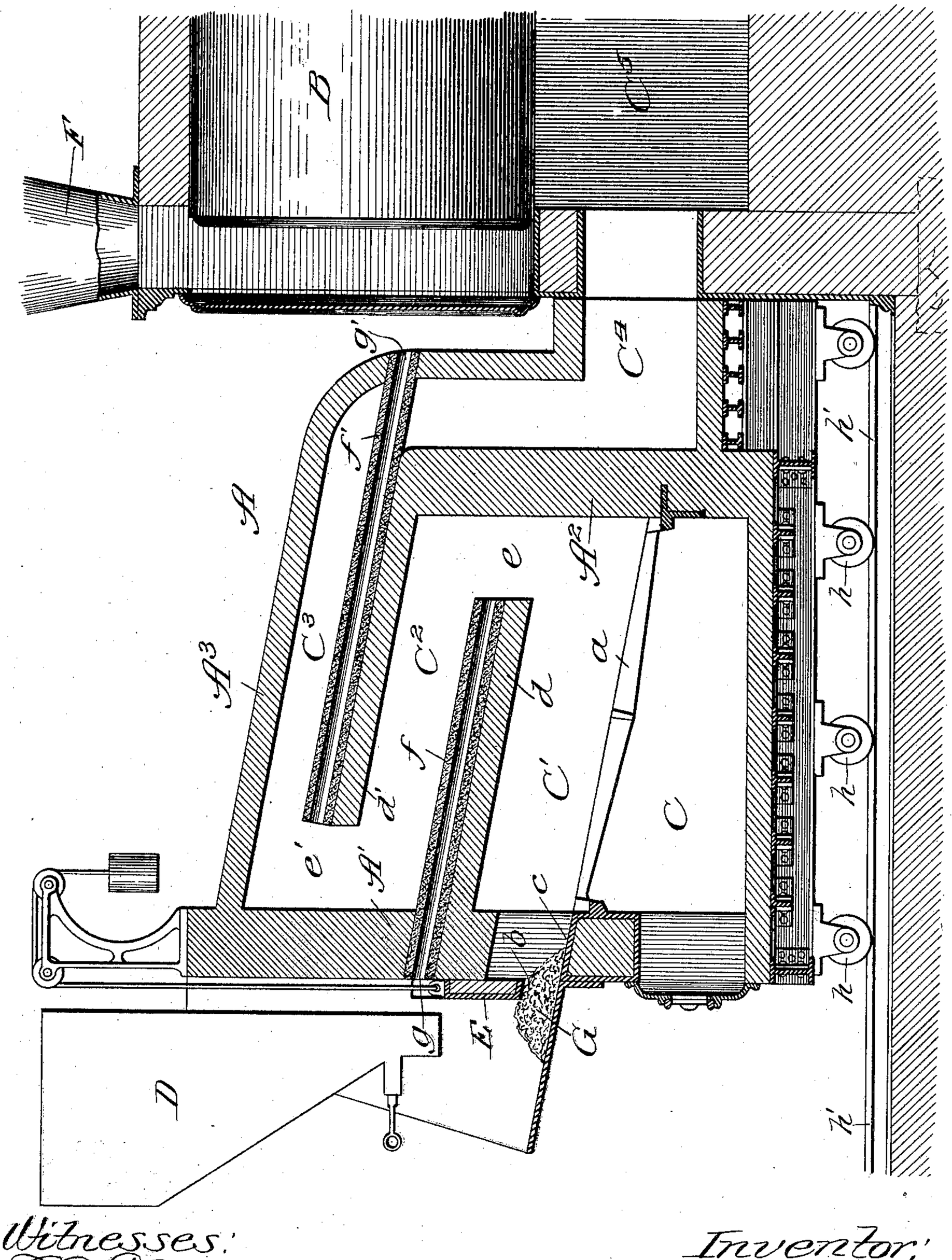
NO MODEL.



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No. 741,346. Patented October 13, 1903.

UNITED STATES PATENT OFFICE.

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SMOKE-PREVENTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 741,346, dated October 13, 1903.

Application filed June 1, 1903. Serial No. 159,438. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. KÖNEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Smoke-Preventing Furnaces, of which the following is a specification.

My invention relates to an improvement in furnaces for promoting such complete combustion of the fuel as to prevent the production from it of smoke.

The primary object of my improvement is to provide a combustion-chamber for boiler-firing and the like which will enable the use of the lower grades of soft coal and produce perfect combustion thereof, thus preventing smoke.

Another object is to provide the heat necessary for boiler-firing without constantly incurring the destructive changes in temperature that would result from sudden cold air admission when the fire-door is opened and at the same time to relieve the crown-sheet and other boiler-sections from the fierce heat of radiation from the fuel-bed and the flues from large and frequent deposits of soot and ashes.

The fundamental principles upon which my improved furnace is constructed are the following: First. Fine atoms of carbon or of heavy hydrocarbons which are liberated by spontaneous distillation require either decomposition or solution in carbonic-acid gas under a temperature approximating 1,800° Fahrenheit, and after their conversion into carbonic-oxid gas and fixed hydrocarbon gases an additional quantity of air is required for their complete combustion, or they must be directly consumed under high and incandescent temperature conditions by means of an excess of air without preliminary solution or decomposition. In practice both of these features of combustion take place, and to obtain the result sought they must be fully provided for. Second. It is necessary that sufficient time and facilities for producing mixture of the products of combustion be provided for in order to enable and compel mixture of the free carbon with the carbonic-acid gas. Third. Sufficient air must be provided to cause ignition of all the combustible gases which have escaped at the point of distillation and which are subsequently formed by dissociation of hydrocarbons or by solution of carbon in carbonic acid.

It may be stated as an indisputable fact that no soft coal which gives off volumes of volatile matter when thrown upon an incandescent bed can be burned without great loss of heat units or without the production of smoke if the volatile ingredients are cooled by coming into too early contact with any portion of a boiler. To meet this condition and cause gradual release of volatile matter, various automatic feeding devices have hitherto been used with good but incomplete results, and they are open to various other objections, such as requiring the use of power and the inability to start a fresh fire under conditions which will eliminate the production of dense smoke at the beginning of operations, and the loss of considerable quantities of hydrocarbon gases is only partially avoided at all times.

To meet the foregoing conditions, I provide a triple-arch forehearth-furnace divided into four superimposed sections or chambers—namely, the ash-pit, the initial-combustion and distillation or fuel chamber, a gas-fixing and carbon-solution chamber, and a final-combustion chamber. The fire-brick arches employed in the construction are in close proximity to each other, being placed only so far apart as is necessitated by the draft requirements, thus compelling intimate contact of the gases with incandescent matter. Each section has its independent air-supply, and the volume and weight of the products of combustion are therefore augmented in their progress through successive sections. Reverberation of the flame and mixing of the products of combustion are assured by the reversal of their course of travel from one section to the other, thereby avoiding stratification of the light hydrocarbons and heavy carbonic-acid gas, as well as supplying free air into intimate mixture with the combustible gases.

The construction thus outlined is illustrated in the accompanying drawing by a view in vertical sectional elevation.

A is the furnace, containing a suitable grate *a* over the ash-pit C and accessible through a fuel-feed opening *b*, at the base of

which is shown a coking-plate *c*. An arch *d* extends from the front wall A′ of the fuel-chamber C′ over the grate in a downwardly-inclined direction toward the rear wall A^2 of the chamber and forms adjacent to the latter the passage *e*. A series of tubes *f*, formed, preferably, of fire-clay and affording air-ducts, extend from air-inlet openings *g* in the wall A′ along the top of the arch *d* to the passage *e*. Above the arch *d* is a similar arch *d′*, extending over it from the wall A^2 toward the wall A′, adjacent to which it forms the passage *e′*. At the passage *e′*, near the top thereof, are the discharge ends of a series of tubes *f′*, like the tubes *f* and extending along the top of the arch *d′* from a series of air-inlet openings *g′*, provided in a downward extension of the wall A^3 of the furnace to open into the chamber C^3, formed between the top of such wall A^3, which constitutes the uppermost arch, and the upper arch *d′*, and which opens into a passage C^4, leading to the space C^5 below the boiler B. The arches *d* and *d′* form between them the chamber C^2 communicating with the chamber C^3 through the passage *e*.

The products of combustion from the burning fuel on the grate reverberate in the initial-combustion chamber against the arch *d* and in rolling through the passage *e* into the gas-fixing and carbon-solution chamber C^2 encounter the flow of air from the tubes *f*, wherein the air in passing through them becomes intensely heated and commingles with the products of combustion to intensify accordingly their combustion. From the passage *e* the products of combustion course through the chamber C^2, wherein they are reverberated between the inclined arches *d* and *d′* and enter the final-combustion chamber C^3 through the passage *e′*, where they encounter heated air from the pipes *f′* to still further enhance their combustion. The hot products of combustion reverberate in and pass through the chamber C^3 into the space C^5 and thence are distributed to the boiler from its farther end, passing out at its opposite end to the stack F.

The repeated reverberation provided for by my improved construction, together with the air supplies successively commingled with the products of combustion in their back-and-forth course, so thoroughly consumes the fuel as to prevent absolutely the presence of smoke in them when they enter the space below the boiler, and I have attained this result by the use of my improvement on the poorest quality of soft-coal slack.

Reverberation of the flame is enhanced by the deflection of the arches, which are depressed in the initial-combustion chamber C′ and final-combustion chamber C^3 in the direction of travel of the products of combustion.

It is desirable to render my improved furnace removable and replaceable relatively to the boiler, so that it may be readily shifted aside when access is required to the boiler for repairing it, and I therefore prefer to provide the furnace as a separate structure supported on wheels *h* to travel on a track *h′*. It is also desirable to subject the fuel to a coking action before introducing it upon the grate. For this purpose I feed it in charges at suitable intervals from a hopper D on the coking-plate *c*, with a vertically-adjustable gate or valve E supported to close the opening *b* only partially, the remainder thereof being closed by the heap of fuel G on the coking-plate, to which the lower end of the gate extends. The fuel affords to the opening *b* a porous closure, through which the air enters the fire-chamber for supporting combustion therein, and the heat in the fire-chamber reverberating against the fuel heap cokes it. In its coked condition the fuel is pushed from time to time upon the grate *a*, and room is thus made for a fresh charge of fuel from the feed-hopper.

The separableness of the furnace enables it to be placed, if desired, at some distance from the boiler, to be connected therewith by a heat-conduit; but it may of course be built in stationary position with relation to the boiler.

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

1. The combination, in a furnace, of a fuel-chamber having an arch of refractory material extending over it and forming the initial-combustion chamber, a plurality of arch-covered intercommunicating chambers communicating with said fuel-chamber and forming therewith a series of flame-reverberating chambers through which the products of combustion pass in a back-and-forth course to the final outlet leading to the object to be heated, and series of air-ducts extending in the path through said chambers of the products of combustion for highly heating the air passing through the ducts, said ducts discharging into said chambers, substantially as and for the purpose set forth.

2. The combination, in a furnace, of a fuel-chamber having an arch of refractory material extending over it from one wall to form the initial-combustion chamber with a passage adjacent to the opposite wall for products of combustion from said chamber, a series of air-ducts extending along said arch and discharging to said passage, a plurality of arch-covered intercommunicating chambers superimposed one over the other above said fuel-chamber and to which said passage leads, said chambers forming with the initial-combustion chamber a series of flame-reverberating chambers through which the products of combustion pass in a continuous back-and-forth course to the final outlet leading to the object to be heated, and a series of air-ducts extending along the arch between said superimposed chambers and discharging into the passage connecting them, substantially as and for the purpose set forth.

3. In a furnace, the combination of a lower arch inclining downward over the fuel-chamber from the front furnace-wall and forming a passage adjacent to the rear furnace-wall for products of combustion from said chamber, a series of air-ducts leading from openings in said front wall along the top of said arch to said passage, an inclining arch extending over said lower arch from said rear wall and forming a passage adjacent to said front wall for the products of combustion, and air-ducts leading to the last-named passage, said arches subjecting the products of combustion in their course along them to repeated reverberation, substantially as and for the purpose set forth.

4. In a furnace, the combination of a lower arch extending over the fuel-chamber from the front furnace-wall and forming a passage adjacent to the rear furnace-wall for products of combustion from said chamber, a series of air-ducts leading from openings in said front wall along the top of said arch to said passage, an arch extending over said lower arch from said rear wall and forming an intermediate compartment, a passage adjacent to said rear wall for the products of combustion and, with the top wall of the furnace, an upper compartment leading to the boiler and communicating with the fuel-chamber through said passages and intermediate compartment, and air-inlets in said front wall leading through air-ducts to the upper said passage, said arches subjecting the products of combustion, in their course along them, to repeated reverberation, substantially as described.

WILLIAM A. KÖNEMAN.

In presence of—
WALTER N. WINBERG,
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