

(No Model.)

F. H. RICHARDS.  
FURNACE.

No. 515,612.

Patented Feb. 27, 1894.

Fig. 2.

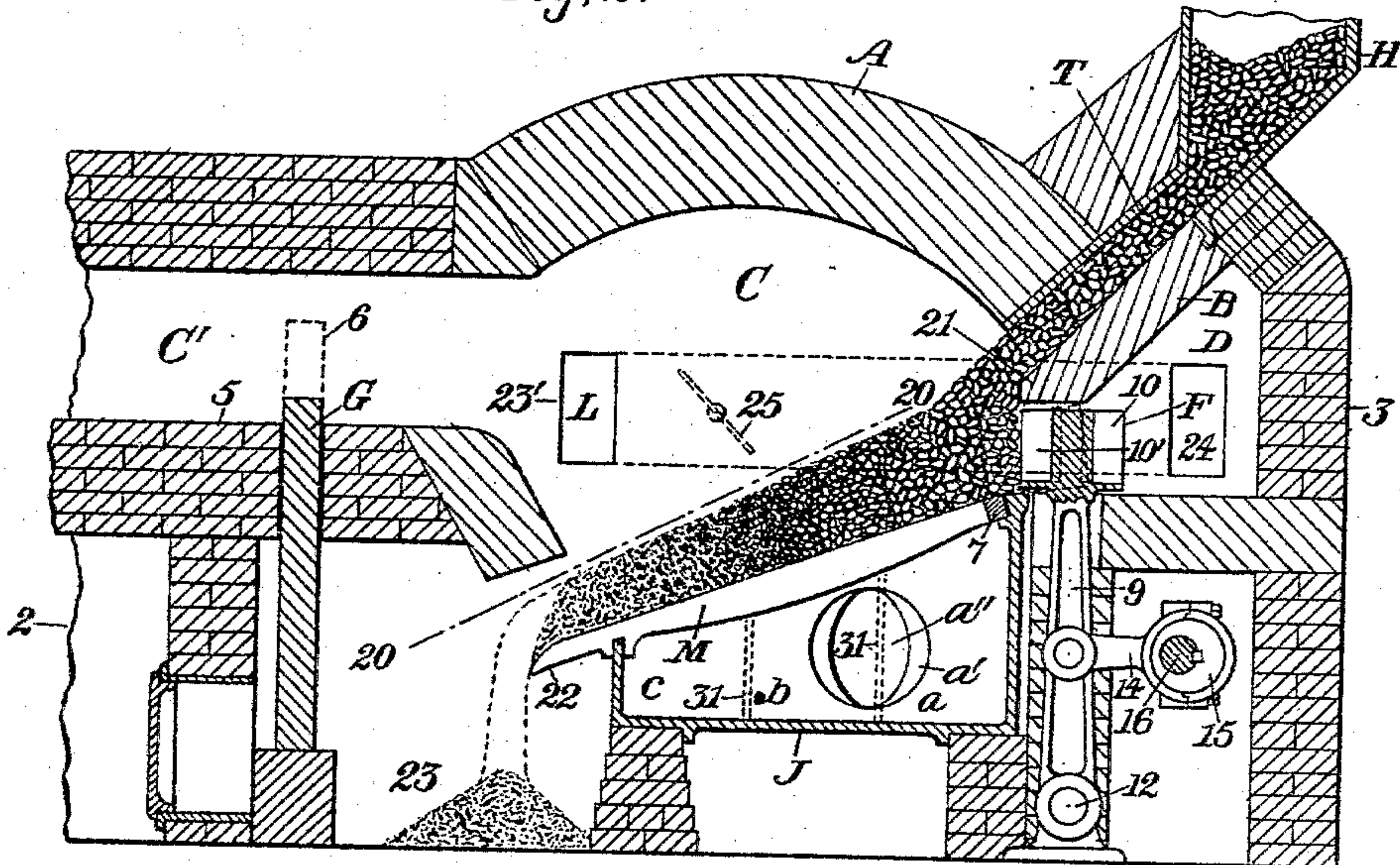
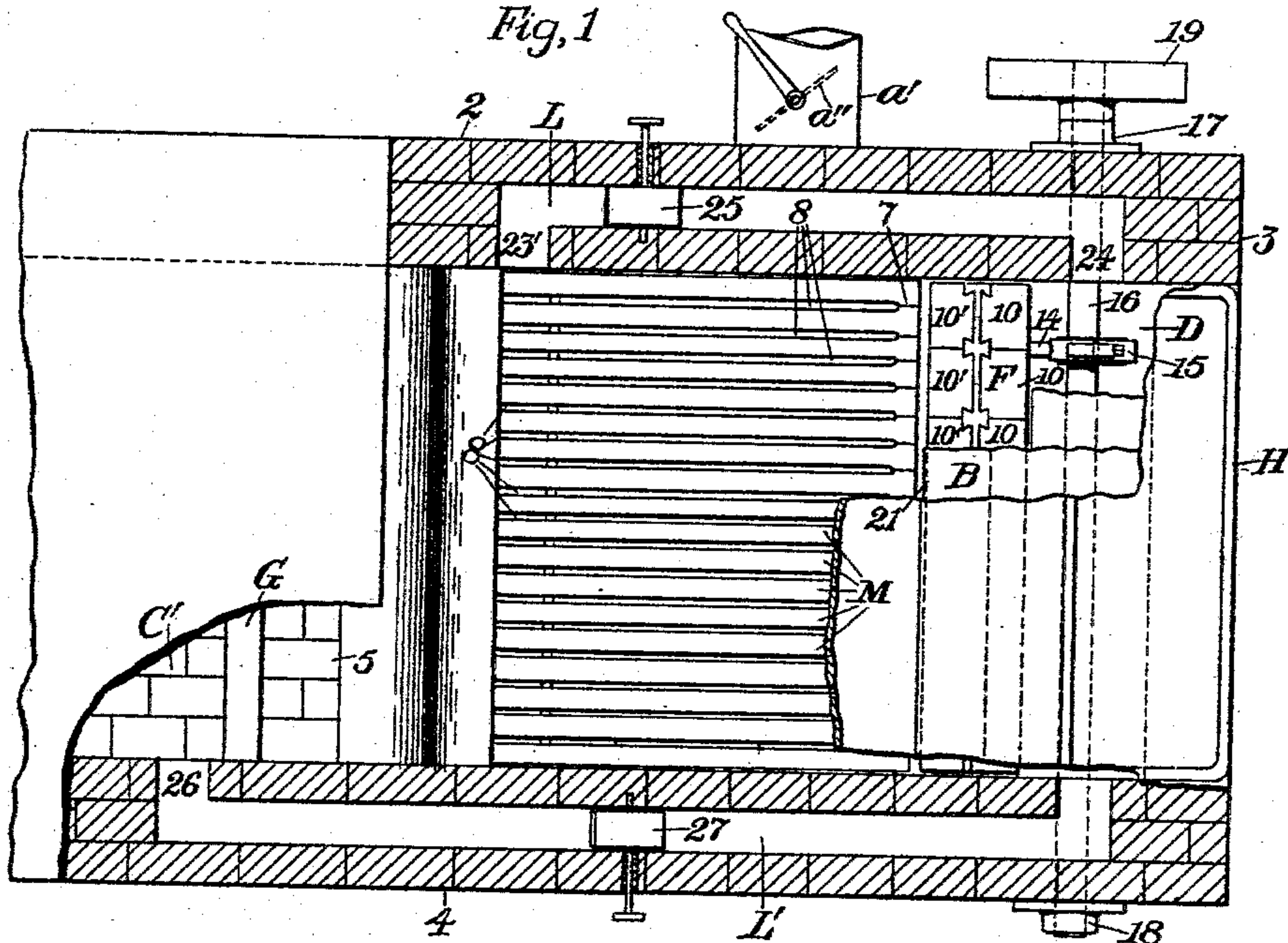


Fig. 1.



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# UNITED STATES PATENT OFFICE.

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## FURNACE.

SPECIFICATION forming part of Letters Patent No. 515,612, dated February 27, 1894.

Application filed December 26, 1893. Serial No. 494,650. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

This invention relates to that class of furnaces in which the fuel is first treated by heating without aeration, the mass then reformed into another and thicker layer and ignited, and afterward carried along the furnace-chamber and consumed.

The object of the invention is to provide a furnace in which the described process may be effectively carried into practice without requiring a traveling grate, and also to provide the furnace with improved means for pre-heating the fuel and for feeding the same over the grate or furnace-floor.

In the drawings accompanying and forming a part of this specification, Figure 1 is a sectional plan view of a furnace embodying my present improvements; in this view, different portions of the furnace structure and mechanism are broken away to different depths, for more fully illustrating the preferred construction and arrangement of the several details. Fig. 2 is a sectional side elevation of the furnace as seen from below in Fig. 1.

Similar characters designate like parts in both figures.

The process of preparing and igniting the fuel which is carried out by the furnace herein shown and described is substantially the same process which is described and claimed in Letters Patent of the United States No. 510,567, granted to Eckley B. Coxe, December 12, 1893, to which reference may be had.

In my improved furnace, the furnace-chamber C is or may be inclosed by the usual furnace-walls; as herein shown, it has the side-walls 2 and 4, the reverberatory or arched roof A, and the front wall 3. The discharge from the furnace-chamber C is through a flue, C', which, of course, may be modified in construction and arrangement, in any desirable manner, without affecting the essential features of my present invention. As a means for regulating the size of said flue (for the

purpose hereinafter more fully described), a gate, or bridge-wall, G, is shown extending upward through an opening in the lower wall 5 of the flue. By elevating or lowering this bridge-wall or gate, as represented, for instance, by dotted lines 6, the area of the flue-outlet may be regulated as required.

The furnace-floor consists of a grate shown formed of a series of parallel bars, M, arranged side by side longitudinally of the furnace-chamber and set at a considerable inclination, as indicated in Fig. 2. The inclination of said grate should be slightly less than the normal angle of repose of the fuel on the grate, so that some force or feeding-device needs to be employed for causing the fuel to travel along down the inclined grate.

As a means for supplying air to the fuel supported upon the furnace-floor, an air-reservoir, designated in a general way by J, is provided, which reservoir will be located directly below the grate and have an outlet or a series of outlets in communication with air-spaces through the furnace-floor, air being supplied to said reservoir through a pipe, a'. This reservoir, or air-blast chamber, may be a single air-supply chamber as shown in full lines in Fig. 2, in which case but one supply-pipe, a', is necessary, which pipe is shown as provided with an ordinary regulating-valve, a'', for controlling the pressure of air in said chamber; or, the reservoir may be divided by vertical partitions, (as shown by dotted lines at 31, Fig. 2,) into a series of separate compartments, a, b, c, each of which compartments will preferably be supplied with air at different pressures by a separate air-supply pipe having a suitable regulating-valve (not shown), in the manner and for the purpose described in United States Letters Patent No. 499,716, granted to Eckley B. Coxe, June 20, 1893, to which reference may be had. This last feature, however, in combination with other features hereinafter more fully described, constitutes, in part, the subject-matter of my present invention.

In the present construction of my invention, the front and rear end-walls of the air-chamber J are herein shown as terminating at relatively different heights, the front-wall being considerably higher than the rear-wall



and terminating at a point in close proximity to the base-line of the furnace-chamber C, as will be understood by reference to Fig. 2.

The furnace-floor may consist, as herein shown, of a grate formed of a series of parallel bars, M, arranged side by side longitudinally of the furnace-chamber and at an inclination thereto, these bars being held in a fixed position relatively to said chamber, and removably supported upon the end-walls of the air-blast chamber J.

As a means of fixedly but removably securing the grate-bars in place, the front end-wall of the chamber J is shown inwardly flanged near its upper end to form a support for the forward ends of said grate-bars, and the lower faces of the grate-bars have lugs near their rear ends on their under faces to engage with the upper edge of the rear-wall of the said chamber J, as clearly illustrated in Fig. 2. It will be obvious, however, that the construction and arrangement just described may be altered without departing from my invention.

Each grate-bar M of the series of grate-bars that comprise the furnace-floor has a lateral projection, 7, at its end which bears against the next adjacent grate-bar when said bars are assembled, to form an air-space, 8, intermediate to said bar, as will be seen by reference to Fig. 1. This construction and arrangement permits the quick and ready removal of any one of the series of grate-bars, and the quick assembling of the same.

Fuel is supplied to the grate from some suitable hopper, as H, through an inclined chute or passage-way, T, whose under side consists of a "hot-slope" wall, or ignition-block, B, extending over the heating-chamber D and terminating at its rearward edge 21 (at the left-hand in Figs. 1 and 2) in a "falling-wall," whose construction, arrangement and mode of operation are fully set forth in the aforesaid Letters Patent No. 510,567. Immediately below the falling-edge 21, at the upper forward edge of the grate, is a fuel-actuator, designated in a general way by F, suitably supported for a reciprocatory movement under said falling-edge 21. Said fuel-actuator consists, in the preferred form thereof herein shown, of some suitable carrier or oscillator, as 9, having on the forward side thereof a series of fire-bricks, 10, and on the rearward side thereof a corresponding series of fire-bricks, 10', whose purpose is to protect said carrier from the heat of the furnace-gases, and also to furnish the proper surface for acting against the fuel as it falls over the falling-edge 21 of the ignition-block B onto the grate. The fuel-actuator F is shown supported at its lower end on a pivot, 12, by means of one or more arms, 13, (Fig. 2) and is connected by some suitable rod or other connection, as 14, with an operating-device for imparting to said fuel-actuator a forward and backward movement. This device may properly consist, as herein shown, of an eccentric,

15, fixed upon a shaft, 16, supported in bearings, 17 and 18, in the furnace-walls 2 and 4, said shaft being provided with a driving-pulley, 19, for rotating the same said shaft. By this means said actuator may be given a regular reciprocatory movement for acting upon the fuel (usually coal of relatively small size) as this runs out of the chute T and falls onto the furnace-floor M.

In practice, the depth of the fuel in the chute T should be considerably less than the depth of the same on the furnace-floor or grate, so that the fuel will be readily heated through as it passes over said ignition-block B, and also that the fuel may be thoroughly mixed and the layer re-formed into a thicker layer as the fuel falls upon the grate.

The fuel-actuator F, by reason of its reciprocatory movement described, operates upon the fuel at the forward edge of the grate to push back the entire mass of the same, which will thereupon naturally assume on its upper side substantially the inclination indicated by the dotted line 20—20, corresponding approximately with the normal angle of repose of the fuel being used, the grate being set, as hereinbefore mentioned and as shown in Fig. 2, at a lesser inclination. By means of the arrangement of features and combinations here described, the fuel may gradually be fed along the grate during the combustion-period, it being first heated and prepared in the chute T, next delivered from said chute mixed and re-formed in a thicker layer upon the forward edge of the grate and this layer afterward forced along the grate over the air-blast chamber, where the carbon is consumed, the cinder and ashes being finally delivered over the rearward end, 22, of the grate into a pit or ash-chamber, 23.

As a means for supplying heat to the heating-chamber D and the heating- or ignition-wall B of the chute T, a flue, L, is led from the point 23 next the rear end and at one side of the furnace-chamber, forward through the wall 2 into said heating-chamber at 24. This flue may be provided with some regulating-device, as, for instance, the valve 25, for controlling the passage through the same of the heated gases. The required draft for creating the suction necessary for securing the circulation of the heated gases through said heating-chamber D, may be obtained by means of another flue, L', leading from said heating-chamber to a point, 26, in the discharge-flue C' of the furnace beyond the regulating bridge-wall or damper G. Another regulating-valve, 27, may also be placed in said suction-flue L' for regulating the draft in the same. If the valves or regulators 25 and 27 be not used in said flues L and L' respectively, the draft through said heating-chamber may be increased by raising the bridge-wall G, as indicated at 6, Fig. 2.

Having thus described my invention, I claim—

1. The herein-described furnace, it consist-



ing of a framework and furnace-chamber having a discharge-flue, in combination with a separate heating-chamber in communication with the furnace-chamber, a fuel-supply chute intermediate to the furnace-chamber and heating-chamber, an inclined furnace-floor supported below the furnace-chamber, and a fuel-actuator in position for bearing against the upper end of the layer of fuel upon the furnace-floor and for forcing the same in a body toward the delivering-end of said floor, substantially as described and for the purpose set forth.

2. The furnace herein described, comprising a combustion-chamber having a discharge-flue, a separate heating-chamber in communication with the combustion-chamber through a flue at one side thereof, a fuel-chute intermediate to the combustion- and heating-chambers, an inclined fuel-supporting floor located below the combustion-chamber, and a reciprocatory fuel actuator located intermediate to the delivering-end of the chute and receiving-end of the furnace-floor and intermediate to the combustion- and heating-chambers, and means for reciprocating said actuator to force-feed the fuel along the furnace-floor, substantially as described and for the purpose set forth.

3. The herein-described furnace, it comprising a suitable framework embodying a furnace-chamber and a heating-chamber divided transversely by an ignition-block, a coal-chute intermediate to said ignition-block and furnace-chamber, a furnace-floor located below and at an inclination with relation to the furnace-chamber, and a reciprocatory fuel-actuator for bearing against the upper end of the layer of fuel upon the furnace-floor, and means for reciprocating said actuator to force-feed the fuel toward the delivering-end of the furnace-floor, substantially as described.

4. The herein-described furnace, it consisting of a furnace-chamber and a heating-chamber separated transversely by an ignition-block or wall, an inclined furnace-floor located below the furnace-chamber with its upper end in substantial vertical alignment with the lower end of the ignition-block, means for delivering fuel at one side of said ignition-block to the furnace-floor, and means for force-feeding said fuel along said furnace-floor, substantially as described.

5. The herein-described furnace, it consisting of a furnace-chamber having a discharge-flue and a heating-chamber separated from said furnace-chamber by a transverse partition or ignition-block and having a flue at one side thereof in communication with said furnace-chamber, and having an air-blast flue at the opposite side thereof in communication with the discharge-flue of the furnace-chamber, a furnace-floor consisting of a series of inclined grate-bars located below the furnace-chamber, a fuel-delivering chute located at one side of the ignition-wall and terminating at its discharge end in the furnace-chamber, and a fuel-actuator located intermediate to the furnace-chamber and heating-chamber in position for bearing against the upper end of the layer of fuel supported upon the furnace-floor, and means for reciprocating said actuator to force-feed the fuel toward the delivering-end of said floor, substantially as described and for the purpose set forth.

6. In a furnace of the class specified, the combination with the furnace-chamber and its walls, of a heating-chamber separated from said furnace-chamber by a transversely-disposed inclined ignition-block or wall, an air-flue located at one side of and in communication with said furnace-chamber and heating-chamber and having a regulator, a furnace-floor located below said furnace chamber at an inclination thereto, means for delivering fuel to the furnace-floor at one side of the ignition-block, an air-reservoir located below and in communication with the furnace-floor, means for supplying air to said reservoir, and means for force-feeding the fuel along the furnace-floor, substantially as described and for the purpose set forth.

7. In a furnace of the class specified having a furnace-chamber with a discharge-flue, the combination therewith of an incased heating-chamber in communication with the furnace-chamber by means of a suitable flue at one side thereof and having a suitable draft-flue at the opposite side thereof in communication with the discharge-flue of the furnace-chamber, a fuel-delivering chute intermediate to the furnace- and heating-chambers and having the ignition-wall adjacent to said heating-chamber, an inclined furnace-floor located below the furnace-chamber, means for delivering air below said furnace-floor, an air-supply chamber located below the furnace-floor, means for supplying, and for regulating the supply of, air to the furnace-chamber, a reciprocatory fuel-actuator located between the furnace-chamber and heating-chamber in position for bearing against the upper end of the layer of fuel upon the furnace-floor, means for reciprocating said fuel-actuator, and means for regulating the draft in the discharge-flue of the furnace-chamber, substantially as described and for the purpose set forth.

8. The combination, in a furnace of the class specified having a furnace-chamber and a heating-chamber substantially as set forth, of an inclined furnace-floor located below the furnace-chamber and consisting of a series of grate-bars having air-spaces intermediate thereto, an air-supply chamber located below and in communication with the air-spaces of the grate-bars, means for supplying air to said supply-chamber and for regulating the pressure of the air-supply, a fuel-delivery chute intermediate to the furnace-chamber and heating-chamber, a fuel-actuator located in position for bearing against the upper end



of the layer of fuel upon the furnace-floor, and means for actuating said fuel-actuator for force-feeding the fuel along said furnace-floor, substantially as described and for the purpose set forth.

9. The combination, in a furnace of the class specified having the furnace-chamber and heating-chamber separated transversely by an ignition-wall substantially as described, of an inclined furnace-floor located below the furnace-chamber with its upper end approximately in vertical alignment with the lower end of the ignition-wall, means for delivering fuel along one face of the ignition-wall to the furnace-floor, a fuel-actuator located below the ignition-wall in position for bearing against the fuel as it is delivered to the furnace-floor, means for reciprocating said actuator to force-feed the fuel along the furnace-floor, means for delivering air below the furnace-floor and for regulating the pressure of the same, and means for regulating the draft in the furnace-chamber, substantially as described and for the purpose set forth.

10. The herein-described furnace, comprising a furnace-chamber having a discharge-flue with a draft-regulating gate or damper therein, a heating-chamber with an ignition-block separating it transversely from the fur-

nace-chamber, a furnace-floor supported upon the end-walls of an air-supply chamber located below said furnace-floor, means for supplying air to said chamber and for regulating the pressure thereof, a reciprocatory fuel-actuator in position to bear against the fuel at the upper end of the floor, and means for operating said fuel-actuator, substantially as described and for the purpose set forth.

11. In a furnace, the combination with the furnace-chamber and a grate therefor, of an inclined chute in position for supplying fuel to the grate, and a separate heating-chamber underneath the chute for heating the fuel during the passage of the same through the chute, substantially as described.

12. In a furnace, the combination with the furnace-chamber and its inclosing-walls, of a heating-chamber forward of the furnace-chamber, an inclined ignition-wall, substantially as described, between the two chambers, and means for supplying fuel to the furnace-chamber over said wall, substantially as described.

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