

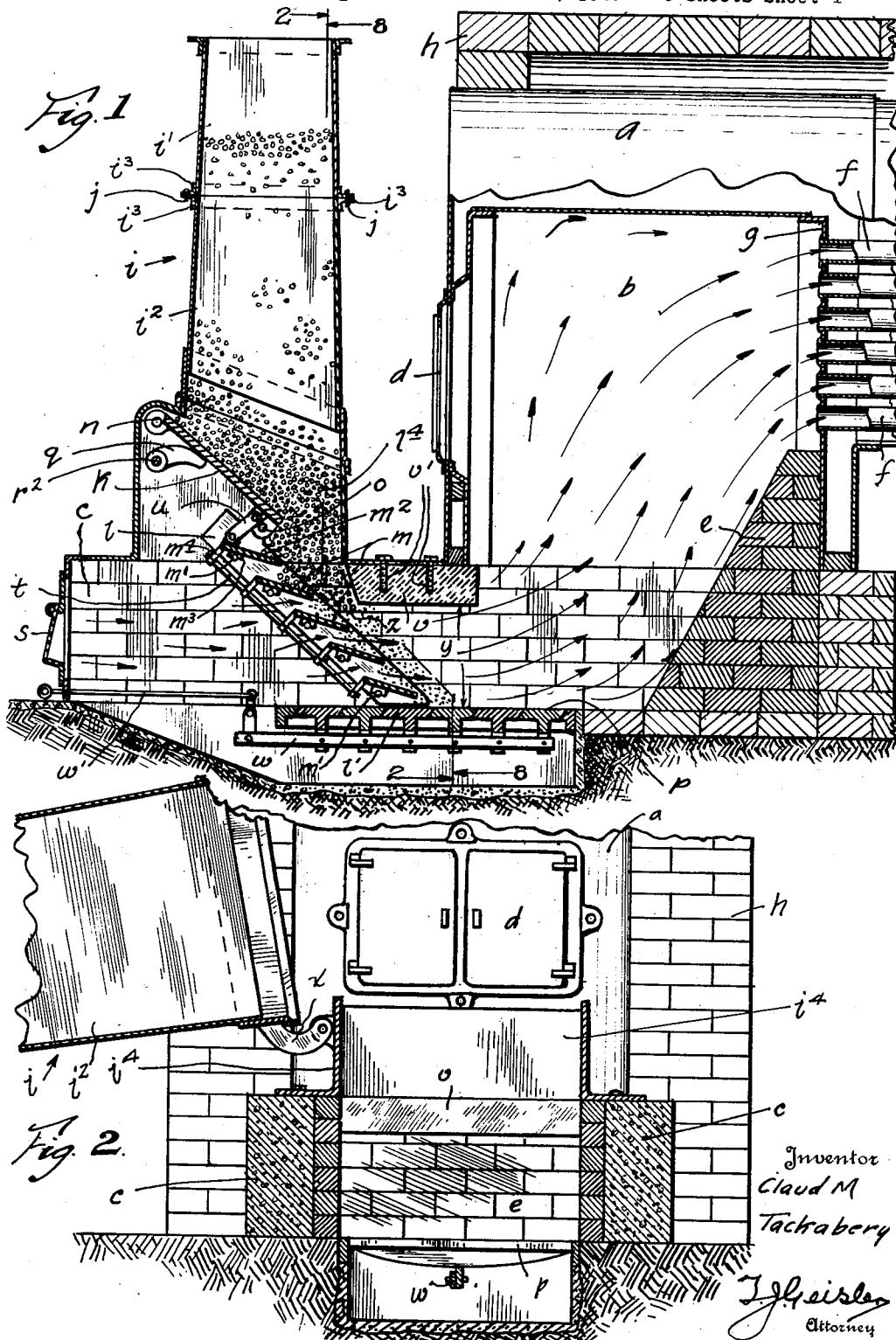
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FUEL FEED FOR FURNACES

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FUEL FEED FOR FURNACES.

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To all whom it may concern:

Be it known that I, CLAUD M. TACKABERY, a citizen of the United States, and a resident of Portland, county of Multnomah, and State of Oregon, have invented a new and useful Improvement in Fuel Feed for Furnaces, of which the following is a specification.

My invention relates to means for adapting a furnace to burn sawdust and other types of fuel which is broken up into small pieces. Sawdust and like types of fuel are difficult to burn in that they mass compactly and thus do not permit sufficient air to be supplied to promote combustion in an efficient manner.

The main object of my invention, therefore, is to provide a simple gravity fuel feed for a furnace, which is suitable for feeding sawdust and other small particle fuels into the fire box, supporting these particles so that air in sufficient quantities may pass through them. Furthermore, to provide means which do not interfere with the use of the furnace for burning ordinary fuel, but permits the latter, by the mere adjustment of the fuel feeding devices.

A further object is to provide a fuel-feeding means, of this character, with a hinged grate element which may be adjusted as to angularity, and in its different positions will provide a passage way for the fuel into the fire box. The grate bars thus themselves provide the control for the fuel being fed; and as the fuel is deposited on the grate it is subjected to combustion, and thus large masses of fuel are prevented from entering the throat of the fire box at one time.

A further object is to provide a grate for a self-feeding means of this character in which the grate bars are inclined at an angle, with a horizontal plane and this angle is substantially constant in all adjustments of the grate as a whole, in this way properly supporting the fuel on the grate bars of the grate, and preventing the fuel from being prematurely discharged from the grate bars by any angular adjustment of the grate.

A further object is to provide a fuel feed, of the character described, with a magazine of substantial size, and of relatively large cross section which is open at the bottom, and the bottom end is directly over the grate so that the fuel falling from the bottom of the grate falls directly on the grate bars, and does not have to slide over an inclined chute or other means on which it might have a tendency to mass and thus feed unevenly, unless supplemental mechanical means were provided for feeding the fuel into the fire box.

A further and more specific object is to provide a magazine for the means previously described which is made with a number of removable sections so as to vary the capacity. Each successive section enlarging in cross-section downwardly so as to prevent fuel from sticking to the sides thereof and the lower one of said magazine sections being hingedly connected to the hopper of an extension of the fire-box, so that the magazine can be swung back out of the way.

Details of construction and the operation of my invention, are hereinafter fully described with reference to the accompanying drawings in which:

Fig. 1 is a horizontal section through a furnace with my self-feeding attachment in place, the arrows in this figure show the approximate direction of the air through the device and the furnace;

Fig. 2 is a section taken on a line 2-2 of Fig. 1 and shows how the reservoir may be swung out so as to give easy access to the fire doors of the furnace;

Fig. 3 is an enlarged sectional detail of a portion of my self-feeding means and shows the two maximum adjustments in each direction, the grate element in full lines, showing the maximum open position, and the broken lines showing the grate elements at most nearly closed position;

Figs. 4, 5, and 6 are perspective views showing details of construction;

Fig. 7 is an outside perspective view of my self-feeding attachment in place on a standard fire box boiler;

Fig. 8 is a section taken on the line 8—8 of Fig. 1; and

Fig. 9 is a fragmentary elevation of the magazine, showing the hinge which permits the upper portion of the reservoir to be swung back so as to permit easy access through the fire doors.

My fuel feeding device is adapted for use in any standard furnace as *a*, having a fire box *b*. In the design shown in the accompanying drawings I have provided an extension *c* which is attached to the fire box through the opening normally closed by the lower grate door, but when my device is in place this provides a passage way through which the fuel is fed. The fire door, as *d*, is left in place and if it is desired to burn refuse, this may be fed through this door as formerly. Fire boxes of this type are usually provided with a bridge wall *e*, and the fire flues *f* are arranged horizontally and open to the fire box through the tube sheet *g*. The furnace is preferably closed by brick work *h*, so as to retain the heat generated more efficiently.

My fuel feeding device consists of a fuel container or magazine *i* which is preferably made in sections which are readily removable and thus the capacity of the magazine is readily changed to meet conditions. The sections *i*¹ and *i*² shown in the accompanying drawings have outstanding flanges *i*³ which are fastened together by bolts *j*. The upper and lower ends of the reservoir are open and the fuel passed from the lower end is controlled by an adjustable grate element made up of diverting plate *k* and grate sides *l* having a number of grate bars *m* adjustably held therein.

The diverting plate *k* is pivotally supported as at *n* by means of ears *n*¹ and is connected to the grate rack *l* as at *o* by ears *o*¹. The lower end of the grate rack is bevelled as at *l*¹ and rests on the ash pit grate bars *p*. The cam *q* adjusts the angularity of the grate element with the mouth of the magazine and this is controlled by a pawl *r*, which connects with the ratchet *r*¹ which is mounted on the shaft *r*² on which the cam also is mounted. Thus by rotating the shaft *r*² the cam is moved and the movement of the cam adjusts the grate element to the position desired.

Air is admitted to the extension *c* through the draft door *s* and the air passes between the grate bars *m* and into the fire box *b* and thence out through the fire tubes *f* to the stack. The grate bars are connected by an adjusting rod *t* by arms *m*⁴ and are pivotally connected to the sides of the grate *l* by means of pins *m*¹, thus as the rack *t* is moved longitudinally the grate bars bearing on bifurcated lugs *m*³, are moved angularly about the pivot pins *m*¹.

A link *u* is pivotally connected to the de-

flector plate *k* by ears *u*¹ and to the uppermost grate bar *m*² by ears *u*² and is so proportioned that as the deflector plate *k* is moved angularly about its pivot end, it causes the grates *m* to be so moved that they always assume substantially the same relative position to a horizontal plane.

I provide a fire tile or slab *v* which is mounted directly over the lower end of the grate element and which materially cuts down the cross sectional area of the extension *c* and thus causes the velocity of the draft passing through at this point to be materially increased by that fact. This fire tile or slab is held in place by studs *v*¹ which fasten it to the extension *c*.

The ash grate bars *p* abut against each other and thus present no openings which might constitute a draft for the fuel being burned. These ash grates are rotated by a rod *w* which in turn is moved by a pull handle *w*¹ which is connected therewith. The hopper for the magazine, as *i*⁴, is fast with the extension and the portion *i*² is hingedly connected thereto by the hinges *x*, thus, as shown in Fig. 2, the magazine when empty, can be swung sidewise from the base *i*⁴ and thus permit easy access to the fire door *d*.

The operation of my device is as follows:

My fuel feeding device is designed so that it may feed a number of different types and sizes of fuel and thus the grate elements are adjustable to accommodate these different types and sizes. Therefore when the reservoir is filled with a certain type of fuel the grate bars are adjusted so that this type of fuel will feed properly into the fire through the mouth *z* which is the space between the grate and the corner of the fire tile *v*. If the fuel is large and of the type known as hog fuel the grate element is lowered to a position approximately as shown in full lines in Fig. 3 that is the grates are lowered so that the mouth *z* will be opened to its widest adjustment, and the grate rack will assume its point nearest the horizontal plane. The grate bars will then present substantially their entire width and the spacing between them will be relatively smaller, thus a great quantity of fuel can be present on the grate bars at one time and the air fed there through will enter through relatively smaller slits and thus the fuel will lie on the grate bars for a longer period of time and will be heated to a higher degree relatively before the blast of air from between the grate bars is drawn against it.

This is necessary because fuel of this character does not burn as readily as lighter grades but does not mass so compactly and therefore leaves larger and more numerous voids between the particles of fuel. If on the other hand the fuel fed into the furnace is sawdust the grates are raised so that

they assume the position shown in broken lines in Fig. 3, which is the position in which the grate element more nearly closes the opening adjacent the corner v^2 of the fire tile or slab v . The grate rack l assumes its most nearly vertical position in this adjustment, and the grate bars are spaced apart in a vertical plane relatively greater than their former adjustment. Thus the fuel in the form of sawdust, which is fed onto the grate bars, is subjected to a larger percentage of air moving at a relatively slower rate of speed, and a relatively less amount of fuel is fed into the grate bars. It can, therefore, be seen that a less amount of fuel will be burned at one time and relatively greater amount of air will be permitted to act on the fuel. The distance y or the height of the throat between the lower face of the fire tile v and the ash grates p is relatively less than at any point in the extension c and thus the velocity of the draft at this point is relatively greater. The contracted orifice results in the speeding up of the velocity of the draft and, therefore, results in a more rapid combustion and in a relatively higher degree of heat during this combustion. The fire tile or slab retains the heat for a longer period than does metal and thus the tiling after it has been heated by the combustion of the fuel retains this heat for a long period and thus aids the combustion of the fuel which is fed into the space below. The space between the fire tile and the ash grates, which I have designated as a throat, resembles a large blow torch into which the small particles of fuel are gradually fed.

It is understood that the sawdust in the container or reservoir i is fed downwardly into the grates merely by gravity and when a portion is burned it will move down on the grates and will permit a similar amount of sawdust to follow on the upper portions of the grate element. This continues until the supply in the reservoir has been exhausted. As will be noted in Fig. 1, the sides of the reservoir diverge downwardly and thus prevent particles of sawdust from adhering to the sides of the container and thus block the passage of the sawdust downwardly. The only portion of the container which presents inclined surfaces to the sawdust aside from the grate bars themselves is the diverting plate k . It has been found by experiment that the fuel in passing outwardly from the container will not slide down the diverting plate but the fresh fuel will be supplied from a point immediately above the opening between the end of the diverting plate and the adjacent side of the container and thus this presents no difficulty until the fuel is almost exhausted.

Note that the grate functions as a closure for, and thus controls, the opening of

the mouth of the throat of the furnace; and in performing that function it is necessary that the grate carry a substantial fuel portion above the mouth of the throat. But whether said fuel portion is carried directly on said grate or some member associated therewith or constituting an extension thereof, as, for example, the distributing plate k , and likewise the relative lengths of these two elements, may be left to the discretion of the manufacturer provided the devices as arranged are capable of producing the results described.

I claim:

1. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, a fuel distributing-plate pendently hinged in said extension and adapted for angular adjustment towards the mouth of the throat of the fire box, a grate hinged to the lower end of said distributing-plate, such grate consisting of a plurality of grate-bars hinged on transverse axes in steps spaced one above the other, means for positioning said distributing-plate, means for maintaining said grate-bars at a constant angle with a horizontal plane in any adjustment of the distributing-plate, the lower end of said grate being slidably supported on the plane of the floor of said throat, whereby the adjustment of the distributing-plate correspondingly regulates the size of the mouth of said throat.

2. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, a fuel distributing-plate pendently hinged in said extension and adapted for angular adjustment towards the mouth of the throat of the fire box, a grate hinged to the lower end of said distributing-plate, such grate consisting of a plurality of grate-bars hinged on transverse axes in steps, spaced one above the other overlapping, means for positioning said distributing-plate, means for maintaining said grate-bars at a constant angle with a horizontal plane in any adjustment of the distributing-plate, the lower end of said grate being slidably supported on the plane of the floor of said throat, whereby the adjustment of the distributing-plate correspondingly regulates the size of the mouth of said throat.

3. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, a fuel distributing-plate pendently hinged in said extension and adapted for angular adjustment towards the mouth of the throat of the fire box, a grate hinged to the lower end of said distributing-plate, such grate consisting of a plurality of grate-bars hinged on transverse axes, in steps spaced one above the other and inclined towards said throat,

means for positioning said distributing-plate, means for maintaining said grate-bars at a constant angle with a horizontal plane in any adjustment of the distributing-plate, the lower end of said grate being slidably supported on the plane of the floor of said throat, whereby the adjustment of the distributing-plate correspondingly regulates the size of the mouth of said throat.

4. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, a fuel distributing-plate pendently hinged in said extension and adapted for angular adjustment towards the mouth of the throat of the fire box, a grate hinged to the lower end of said distributing-plate, such grate consisting of a plurality of grate-bars hinged on transverse axes in steps spaced one above the other overlapping and inclined towards said throat, means for positioning said distributing-plate, means for maintaining said grate-bars at a constant angle with a horizontal plane in any adjustment of the distributing-plate, the lower end of said grate being slidably supported on the plane of the floor of said throat, whereby the adjustment of the distributing-plate correspondingly regulates the size of the mouth of said throat.

5. A fuel feed attachment for a furnace having a fire-box, such attachment comprising, an outward extension of said fire box, such extension being provided with a fuel inlet, a fuel-distributing plate pendently hinged in said extension on a transverse axis spaced from the front of the mouth of said throat, the distributing-plate being of lesser length than the opening at the bottom of the magazine so as not to close this opening entirely when the distributing-plate is lifted to its highest position, a grate comprising a plurality of pivoted, plate-like vertically spaced, stepped grate-bars inclined towards said mouth, means for positioning said distributing-plate and in unison therewith the grate and its bars, and adapted to maintain the latter at a constant angle with a horizontal plane in all angular adjustments of the grate.

6. A fuel-feed attachment for a furnace having a fire-box, such attachment comprising, an outward extension of said fire box, such extension being provided with a fuel inlet, a fuel-distributing plate pendently hinged in said extension on a transverse axis spaced from the front of the mouth of said throat, the distributing-plate being of lesser length than the opening at the bottom of the magazine so as not to close this opening entirely when the distributing-plate is lifted to its highest position, means for positioning said distributing-plate, a grate pivotally connected at one end to said distributing-plate, the opposite end of the grate being slidably supported on the plane of the floor

of the fire-box, said grate having a plurality of pivoted, plate-like vertically spaced, stepped grate-bars inclined towards said mouth, an operating connection between said distributing-plate and said grate-bars adapted to position the latter at a constant angle with a horizontal plane in any position of said distributing-plate, means for lifting the distributing-plate on its hinge, thereby to adjust the grate angular and correspondingly regulate the size of the mouth of said throat.

7. A fuel-feed attachment for a furnace having a fire-box, such attachment comprising, an outward extension of said fire box, such extension being provided with a vertical magazine mounted on and discharging into said extension, a fuel-distributing plate pendently hinged at the bottom of the magazine, on a transverse axis spaced from the front of the mouth of said throat, the distributing-plate being of lesser length than the opening at the bottom of the magazine so as not to close this opening entirely when the distributing-plate is lifted to its highest position, a grate comprising a plurality of pivoted, plate-like vertically spaced, stepped grate-bars inclined towards said mouth, means for positioning said distributing-plate and in unison therewith the grate and its bars, and adapted to maintain the latter at a constant angle with a horizontal plane in all angular adjustments of the grate.

8. A fuel-feed attachment for a furnace having a fire-box, such attachment comprising, an outward elongated extension of said fire box, such extension being provided with a hopper, a vertical magazine mounted on and discharging into said hopper a fuel-distributing plate pendently hinged at the bottom of the magazine, on a transverse axis spaced from the front of the mouth of said throat, the distributing-plate being of lesser length than the opening at the bottom of the magazine so as not to close this opening entirely when the distributing-plate is lifted to its highest position, a grate comprising a plurality of pivoted, plate-like vertically spaced, stepped grate-bars inclined towards said mouth, means for positioning said distributing-plate and in unison therewith the grate and its bars, and adapted to maintain the latter at a constant angle with a horizontal plane in all angular adjustments of the grate.

9. A fuel-feed attachment for a furnace having a fire-box, such attachment comprising an outward extension of said fire box, such extension being provided with a fuel inlet, a fuel-distributing plate pendently hinged in said extension on a transverse axis spaced from the front of the mouth of said throat the distributing-plate being of lesser length than the opening at the bot-

tom of the magazine so as not to close this opening entirely when the distributing-plate is lifted to its highest position, means for positioning said distributing-plate, a grate pivotally connected at one end to said distributing-plate, the opposite end of the grate being slidably supported on the plane of the floor of the fire-box, said grate having a plurality of pivoted, plate-like vertically spaced, stepped grate-bars inclined towards said mouth, an operating connection between said distributing-plate and said grate-bars adapted to position the latter at a constant angle with a horizontal plane in any position of said distributing-plate, means for lifting the distributing-plate on its hinge, thereby to adjust the grate angular and correspondingly regulate the size of the mouth of said throat.

10. A fuel-feed attachment for a furnace having a fire-box, such attachment comprising, an outward extension of said fire box, such extension being provided with a fuel inlet, a fuel-distributing plate pendently hinged on a transverse axis spaced from the front of the mouth of said throat, the distributing-plate being of lesser length than the opening at the bottom of the magazine so as not to close this opening entirely when the distributing-plate is lifted to its highest position, a grate pivotally connected at one end to said distributing-plate, the opposite end of the grate being slidably supported on the plane of the floor of the fire-box, said grate having a plurality of pivoted, plate-like vertically spaced, stepped grate-bars inclined towards said mouth, means for positioning said distributing-plate and in unison therewith the grate and its bars, and adapted to maintain the latter at a constant angle with a horizontal plane in all angular adjustments of the grate, a fire resisting cover of substantial thickness secured to the roof of the fire-box at its mouth, the cross sectional area, under said covering, of the mouth of the fire-box being substantially less than the cross-sectional area of said extension.

11. In a furnace, an extension of the fire box of the furnace, such extension provided with a fuel inlet, a fuel distributing-plate hinged in such extension on a transverse axis and adapted for angular adjustment towards the mouth of the throat of the fire box, an inclined grate extending to the floor of the extension of said fire box, said grate being hingedly attached to the free end of said distributing plate thus adapted for angular adjustment, said grate consisting of sides and a plurality of plate-like grate-bars pivoted between said sides in steps spaced one above the other and descending towards the throat of the fire-box and being inclined downwardly towards said throat, means for angularly adjusting the distributing-plate,

and therewith said grate, thereby to regulate the size of the mouth of the throat of the furnace.

12. In a furnace, an extension of the fire box of the furnace, such extension provided with a fuel inlet, a fuel distributing plate hinged in such extension on a transverse axis and adapted for angular adjustment towards the mouth of the throat of the fire box, an inclined grate extending to the floor of the extension of said fire box, said grate being hingedly attached to the free end of said distributing plate thus adapted for angular adjustment, said grate consisting of sides and a plurality of plate-like grate-bars pivoted between said sides in steps spaced one above the other and descending towards the throat of the fire-box said steps overlapping and being inclined downwardly towards said throat, means for angularly adjusting the distributing-plate, and therewith said grate, thereby to regulate the size of the mouth of the throat of the furnace.

13. In a furnace, an extension of the fire box of the furnace, such extension provided with a fuel inlet, a fuel distributing-plate hinged in such extension on a transverse axis and adapted for angular adjustment towards the mouth of the throat of the fire box, an inclined grate extending to the floor of the extension of said fire box, said grate being hingedly attached to the free end of said distributing plate thus adapted for angular adjustment, said grate consisting of sides and a plurality of plate-like grate-bars pivoted between said sides in steps spaced one above the other and descending towards the throat of the fire-box and being inclined downwardly towards said throat, said steps provided respectively with a pendent fixed arm, a bar connecting such arms, a link connecting one of said steps with said distributing-plate, the point of such connection being located relative to the axis of the hinge connecting said distributing-plate with the grate, so that moving the distributing plate will relatively move the grate-bars and maintain the latter at a constant angle with a horizontal plane, means for angularly adjusting the distributing-plate, and therewith said grate, thereby to regulate the size of the mouth of the throat of the furnace.

14. In a furnace a fire door, an extension of the fire box such extension lying below said fire door and provided with a fuel hopper, a fuel magazine supported vertically over said hopper, and normally covering said fire door, said fuel magazine, being hinged thereto by means permitting the magazine to be moved sideways off the hopper, thereby to permit access into said fire door.

15. In a furnace, an extension of the fire box, such extension provided with a fuel

hopper, a removable fuel magazine mounted on said hopper, said magazine composed of removable stacked sections, each section enlarging downwardly and being extensions 5 of each other.

16. In a furnace, an extension of the fire box such extension provided with a fuel hopper, the top of said hopper lying in a plane inclined downwardly towards the 10 throat of the fire box, a fuel magazine supported over said hopper, being hinged thereto by means permitting the magazine to be moved sidewise off the hopper, said magazine composed of removable stacked sections, 15 each section enlarging downwardly and being extensions of each other.

17. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, an inclined movable grate element constituting a closure for 20 the mouth of the throat of the furnace, such grate element being adapted to carry a substantial portion of the fuel above said mouth.

25 18. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, an inclined mov-

able grate element constituting a closure for the mouth of the throat of the furnace, such grate element being adapted to carry a substantial portion of the fuel above said 30 mouth, the roof of said mouth being provided with a fire resisting and heat retaining lining of substantial thickness and functioning also to contract the opening of said 35 mouth for the purpose specified.

19. In a furnace, an extension of the fire box of the furnace, such extension being provided with a fuel inlet, a fuel distributing-plate pendently hinged in said extension and adapted for angular adjustment towards the mouth of the throat of the fire 40 box, a grate hinged to the lower end of said distributing plate, such grate consisting of a plurality of grate-bars hinged 45 on transverse axes in steps spaced one above the other, means for positioning said distributing plate, means co-operating with said distributing plate operating to maintain said grate-bars at a constant angle with 50 a horizontal plane in any adjustment of the distributing-plate.

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