W. McCLAVE.

GRATE FOR BURNING FINE FUEL.

APPLICATION FILED AUG. 29, 1913.

1,134,883.

Patented Apr. 6, 1915.

4 SHEETS—SHEET 1.

Fig. 1.

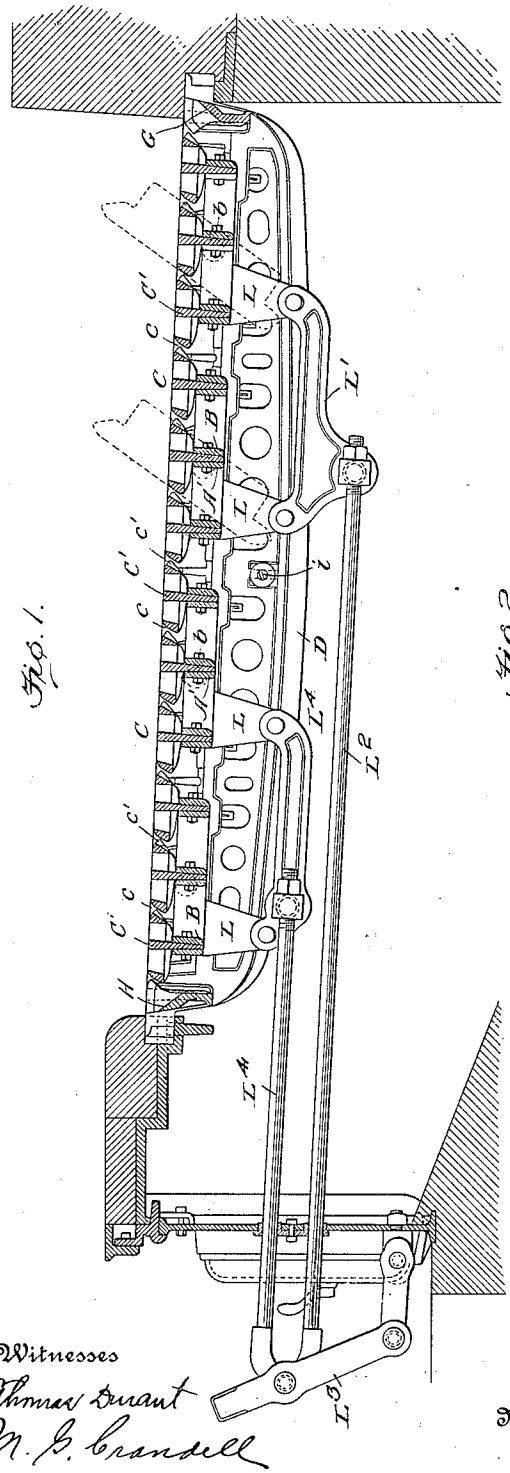
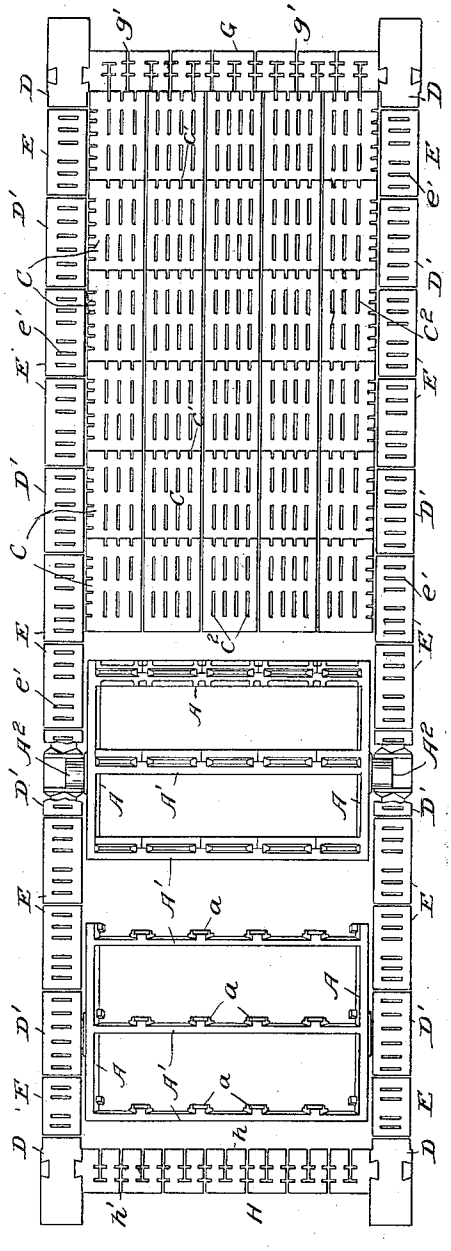


Fig. 2.



Witnesses

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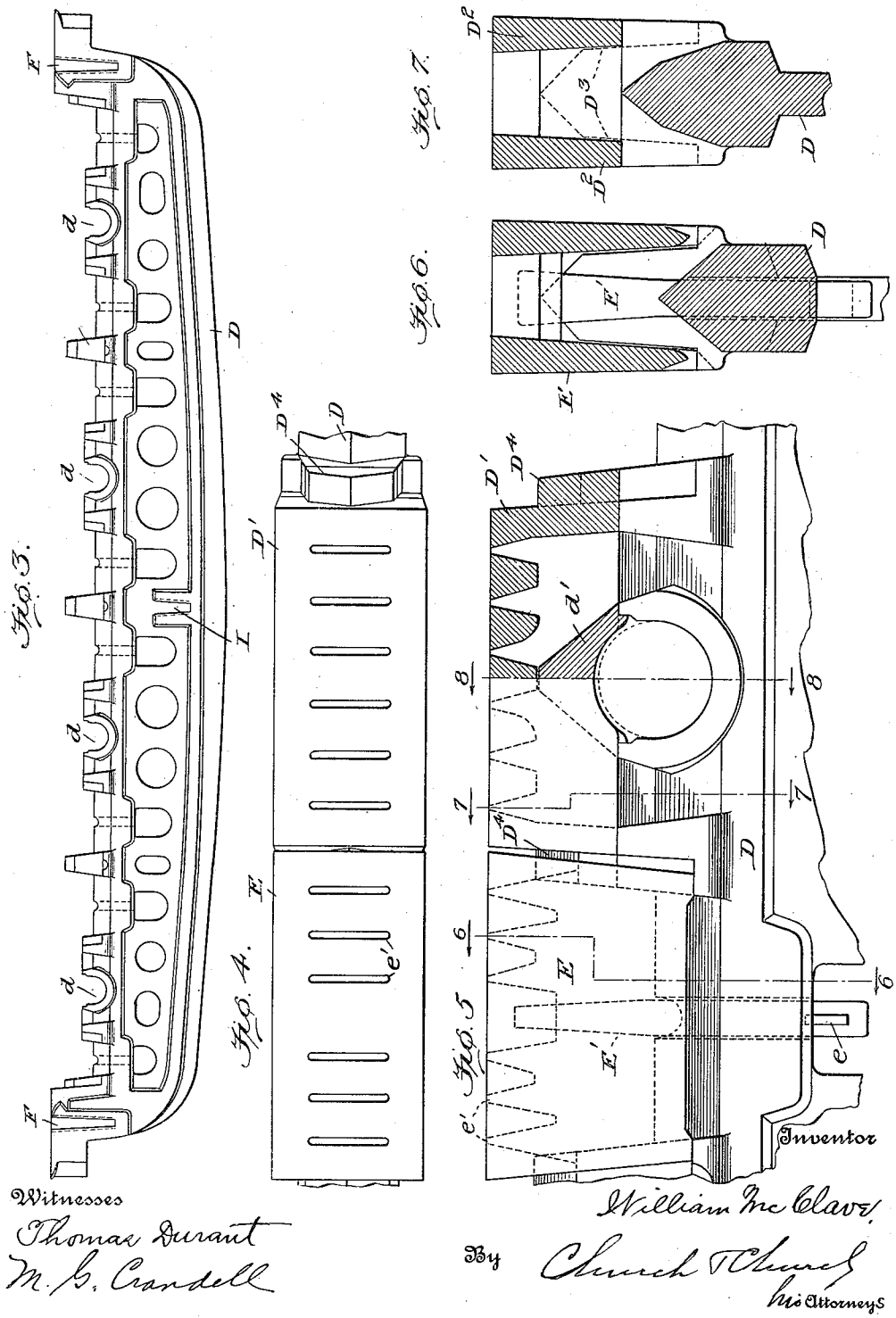

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4 SHEETS—SHEET 3.

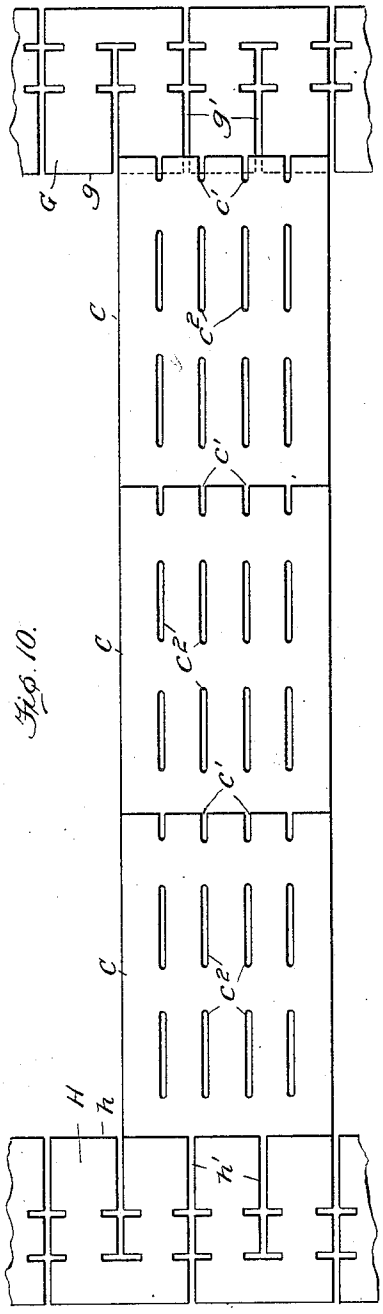

Fig. 10.

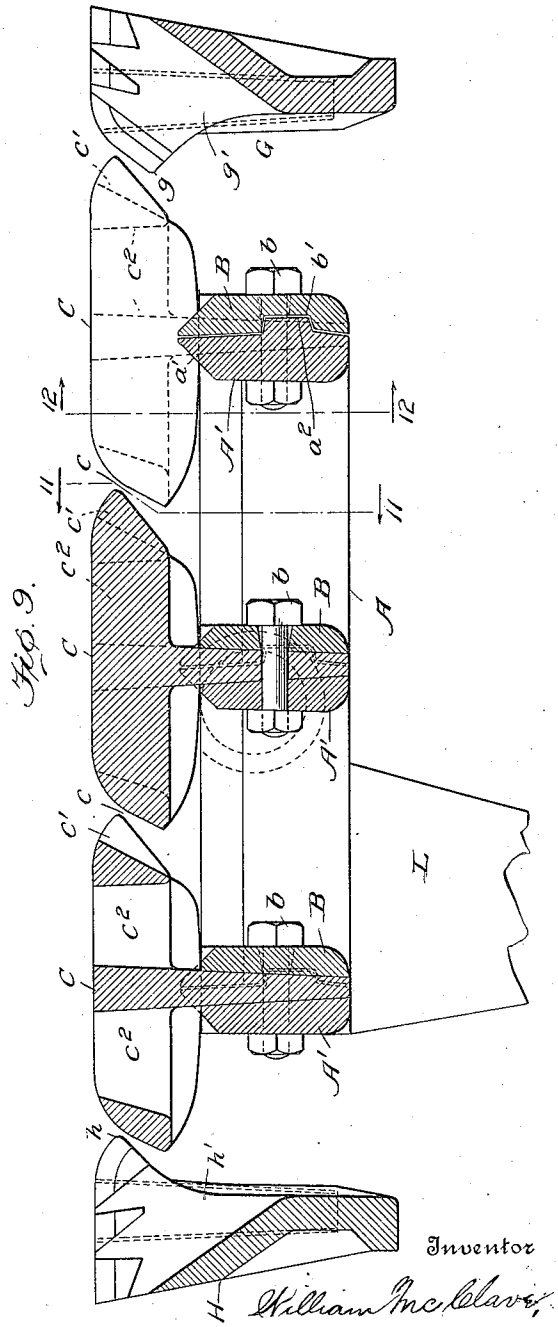

Fig. 9.

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4 SHEETS—SHEET 4.

Fig. 11.

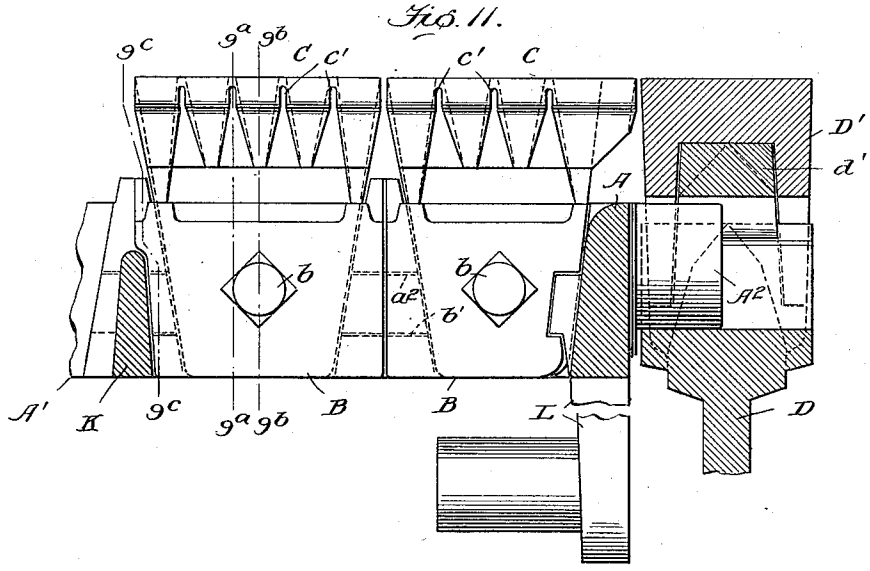


Fig. 8.

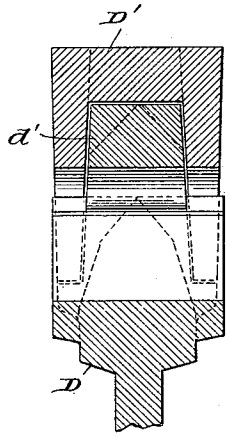


Fig. 12.

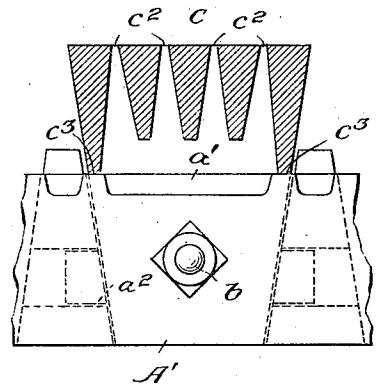
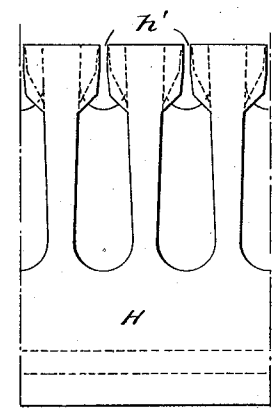


Fig. 13.



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UNITED STATES PATENT OFFICE.

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GRATE FOR BURNING FINE FUEL.

1,134,883. Specification of Letters Patent. Patented Apr. 6, 1915.

Application filed August 29, 1913. Serial No. 787,342.

To all whom it may concern:

Be it known that I, WILLIAM McCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Grates for Burning Fine Fuel; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to grates which are primarily designed for burning the smaller grades of coal, especially anthracite coal, in the burning of which it is essential that the air admission area of the grate be reduced but at the same time distributed uniformly throughout the whole grate so as to supply air to the fuel at practically all points without admitting sufficient air at any one part to blow through the bed of fuel without effecting proper combustion.

In the use of certain kinds and grades of coal fuel which form large clinkers in the ash, it has been found necessary or desirable to employ grates having relatively large dumping or tilting sections in order to facilitate the breaking up and removal of the clinkers, but considerable difficulty has been experienced in so constructing the dumping or tilting sections that worn or burned parts may be readily renewed without the entire replacement of the sections and at the same time guard against the evils incident to the growth of the metal forming the fuel supporting surface, and without disturbing or varying the uniform distribution of the air, especially where the air passages must be necessarily small in grates designed to burn the smaller grades of coal. Other difficulties have been encountered in the manufacture of this type of grate, particularly in the manufacture of the supporting portions in such wise that they could be molded in ordinary flasks and embody a construction which will give a maximum efficiency with the capacity for being easily assembled or taken down for the renewal of burned or worn sections or parts.

The present invention is the culmination of a long series of efforts to overcome the defects pointed out and to produce a grate which will have advantages both from the manufacturer's and the user's points of view, never possessed by this type of grate before, all as will be hereinafter described and pointed out particularly in the appended claims.

Referring to the accompanying drawings,—Figure 1 is a sectional view from front to rear through a furnace grate embodying the present improvements, the grate illustrated embodying four tilting or dumping sections but it will be understood that this number of sections may be increased or decreased if so desired. Fig. 2 is a top plan view of the portion of the grate shown in section in Fig. 1, the two right hand dumping sections being shown with their fuel supporting parts or removable tops in place, the extreme left hand section being shown without the removable top or fuel supporting parts or the clamps for holding the same in place, the second section from the left hand end being shown without the removable tops but with the clamps therefor in place. Fig. 3 is a side elevation of one of the journal bars which extend from front to rear of the furnace between the proximate ends of dumping or tilting section, one of these bars being located at the end of each series of sections to form the bearings and supports therefor. Fig. 4 is a top plan view of a section of the journal bar with the removable tops in place thereon. Fig. 5 is an elevation of the portion of the journal bar shown in Fig. 4, with some of the parts at one end in section. Fig. 6 is a transverse section substantially on the line 6—6 of Fig. 5. Fig. 7 is a similar section substantially on the line 7—7 of Fig. 5. Fig. 8 is a section substantially on the line 8—8 of Fig. 5. Fig. 9 is a detail sectional elevation on an enlarged scale showing one of the dumping or tilting sections of the grate with its removable tops, the left hand removable top being in section on the line 9^a, the middle removable top being in section on the line 9^b and the right hand removable top being in elevation, the sectional part being on the line indicated at 9^c, Fig. 11. In this view the front and back frame ends are shown in the positions they would occupy with relation to the front and rear dumping sections of the grate. Fig. 10 is a top plan view of the parts shown in section in Fig. 9. Fig. 11 is a sectional elevation of one end of a dumping or tilting section

substantially on the line 11—11 of Fig. 9. Fig. 12 is a sectional elevation showing the cross sectional form of one of the removable tops, the plane of the section being indicated in Fig. 9 at 12—12. Fig. 13 is an elevation of a fragment of one of the frame ends showing the form of the air passages therein.

Like letters of reference in the several figures indicate the same parts.

The grate of the present invention, as before stated, embodies a series of dumping or tilting sections, each made of relatively large size and each lumping or tilting section comprises a rigid grid or frame of substantially rectangular form, that is to say, it is formed with end bars A and longitudinal bars A′, best seen at the left hand end of Fig. 2. Each end bar is provided with a suitable journal adapted to be supported in a suitable bearing in a bearer bar D. The bearer bars extend from front to rear of the furnace and are suitably supported at their ends from the furnace walls in any approved or well known manner, and embody certain novel features of construction which will be hereinafter referred to.

The dumping or tilting sections, the frame work of which is formed by the rigid grids A, A′, have fuel supporting caps or removable tops which, as compared with the area of the grate are relatively small so as to be of convenient size for manufacture and replacement or assemblage of the parts, each of the longitudinal bars A′ being adapted to support a series of such removable caps or tops. The caps or tops are arranged preferably with the greatest length of their fuel supporting surfaces transversely of the bars on which they are mounted, and in order that the air area of the grate may be reduced to the necessary minimum, and at the same time provision be made for the growth of the metal without interfering with either the operation of the sections as a whole or of the individual removable tops forming the sides of the fuel supporting surface, the adjacent ends of the relatively fixed removable tops of each of the sections are made to overlap and underlap, respectively, whereby the division line or space between them will be inclined or diagonal to the general plane of the grate, with the result that each individual removable top in each dumping section may grow or expand to a far greater extent than would be possible were the proximate edges of the removable tops arranged in direct opposition to each other.

Referring now particularly to Figs. 1, 2, and 9 to 12, it will be seen that each dumping section is provided with three bars A′, and each bar A′ is provided with a series of removable tops C arranged side by side. The proximate ends of the removable tops C on adjacent bars overlap and underlap at *c*, leaving a comparatively narrow inclined air inlet opening between the proximate ends, but inasmuch as the expansion of the metal takes place in the plane of the grate or in a plane diagonal to the passage a much greater expansion is permissible than would be possible were the surfaces directly opposed to each other in the plane of the grate. Each removable top C has at one end narrow air passages c' and within its body a series of narrow air passages c^2, all of said passages being tapered upwardly or flared downwardly, as shown in the elevation, Fig. 11, and in section in Fig. 12.

The overlapping and underlapping effect is secured by beveling the opposite ends of the tops upwardly or downwardly, as the case may be, and in rounding the end of the bevel to bring the overlap below the plane of the fuel supporting surface. With this construction a fuel supporting surface is presented which will not catch the implements with which the bed of fuel is manipulated.

The bars A′ forming the frame or grid of each section are parallel with the axis of the section and are provided on one side with the projections *a* having oppositely disposed downwardly inclined faces forming in effect recesses or seats in which fit the downwardly tapering shanks C′ of the removable tops C. These shanks C′ are relatively thin but wide transversely of the length of the tops and are formed integral therewith but taper downwardly in both directions, as will be readily understood from Figs. 9 and 11. The projections *a* on the bars A′ preferably extend slightly above the general plane of the bar, their upper faces being inclined as shown at *a′* in Fig. 9 so as to prevent accumulation of ashes thereon, and in fact the upper edge faces of the bars are preferably inclined wherever ashes could fall upon the same, either between the removable tops or through the air openings in said tops. All of the shanks with removable tops are mounted against corresponding sides of the bars A′ and are clamped in place by individual clamps B each clamp being held against its shank by a through bolt *b* having a head at one end and a nut at the other, to which wrenches may be applied for tightening up the parts or for separating them when a new top is to be substituted. By the arrangement of the removable tops all on corresponging sides of the bars A′ it becomes possible with the over and underlapping arrangement to renew any one of the tops without disturbing the fastenings for the other tops of the section. Obviously this would be impossible were the shanks dropped into sockets in the bars, such as would not permit of lateral movement when the fastening means is loosened.

The overlapping end of each top is, as shown in Fig. 9, preferably the end on the

side of the shank against which the clamp seats, as this facilitates, to some extent, the ready insertion and removal of the parts. In order to support the clamps against any lateral movement their proximate edges are abutted, as shown in Fig. 11, and they are provided on their inner faces with recesses b' for the reception of projections or lugs a^2 on the bars or projections a, whereby their up and down movement is prevented. The projections and recesses a^2 and b' are preferably provided with inclined top and bottom faces, so that the parts will interlock and fit together and prevent any looseness after the bolts are set up, but will readily free themselves when the bolts are loosened. The side portions of the removable tops, as shown in Fig. 12, are somewhat wider in a vertical plane than the intermediate portions and are adapted to rest squarely upon the upper edges of the bars A′ and clamps B, at the point indicated by the reference letter a^3, where a substantially flat surface is provided, as shown by dotted lines in Fig. 9.

The journals A^2 near the center of the ends of each section rest in bearings formed in bearer bars indicated generally by the letter D. These bearer bars are of proper sectional conformation to distribute the metal properly for supporting the load of the grate, and except at the ends are located entirely below the plane of the fuel supporting surface, whereby they are protected in a large measure from the destructive action of the fire. Their upper edges are, however, somewhat peculiarly formed, in order that they may receive and properly support the dumping or tilting sections and also receive and support a series of fixed removable tops which will constitute a part of the fuel supporting surface lying at the same level as the tops of the dumping sections. Referring particularly to Figs. 3 to 8, it will be seen that the bearer bar shown in Fig. 3 is provided with four open bearings d, this particular bar being designed for a four-section grate. Each bar is provided with a removable cap or top portion d', thus forming a complete housing for the journal. Each intermediate bearer bar is adapted to receive the journals of dumping sections on each side thereof, and they are therefore made of sufficient thickness to accommodate both journals, as will be readily understood from Fig. 11. The removable caps d' seat on the walls forming the bearings but are adapted to be held in place and, in fact, surrounded and confined by a removable top D′, as will be readily understood from the left hand end of Fig. 5 and Fig. 8, which is a section through the bearing cap and top. The caps D′ have downwardly extending lugs or side portions D^2 which fit on each side of and seat against inclined faces D^3 formed on projections extending upwardly from the upper edge of the bearer bar and at the ends of each of the sections D′ they are provided with projections D^4 (see Figs. 4 and 5), said projections being adapted for the reception of the end portions of removable tops E which are mounted on the bearer bar intermediate the bearing and adapted to be held firmly down in position by downwardly extending stems E′ passing through openings in the bearer bar and having means whereby they may be drawn down into place, such, for example, as a slot e for the reception of a taper pin or key, or the said ends may have a nut applied thereto in the ordinary manner.

The stems E′ are preferably integral with or anchored firmly in the tops E as shown in Figs. 5 and 6, but their cross sectional area is relatively small and the intermediate portions of the tops are of such dimension as to leave relatively large air spaces within the tops, which, at their upper ends converge into narrow air openings e', as shown in Fig. 4.

Wherever the bearer bar or the upper edge of the bearer bar is liable to receive ashes passing down through the air inlet openings or otherwise falling upon the same, the upper edge surfaces are beveled, or inclined, as shown clearly in Figs. 6 and 7, thus allowing any ashes which may fall thereon to slide down into the ash pit, leaving the air openings clear and the surface of the iron exposed to the action of the air for cooling.

The construction of the bearer bars with their removable tops, it will be noted, is such that those tops which are located over the bearings serve to hold the caps of the bearings in place, and while they have no fastening means connecting them directly with the bearer bars they are fastened by the intermediate tops E which overlie the end projections D^4 and are themselves firmly anchored by their shanks E′ so that the whole line of removable tops will be held firmly in place and the fuel supporting surface will substantially conform to the general fuel supporting surface formed by the dumping or tilting sections. The arrangement is furthermore of such a character that the removable tops of the tilting or dumping sections may be made to work close to the edges of the removable tops of the bearer bars, thus forming between them air admission openings or cracks which will substantially conform in sectional area to the air admission openings or cracks in the other portions of the grate, and thereby insure a uniform distribution of the air to all parts of the bed of fuel.

Near their extremities the bearer bars D are provided with dove-tail tapering sockets F for the reception of correspondingly shaped projections on the ends of back and

front end bars G and H respectively, said back and front end bars serving to make the whole structure rigid and properly space the bearer bars. Said back and front end frames are formed as shown in Figs. 9 and 13, that is to say, they have downwardly and upwardly curved edge projections g and h which correspond in form to the form of the ends of the removable tops of the dumping or tilting sections, thus preserving the over and underlapping constructional feature of the grate, and maintaining the proper proportion of air inlet openings. In addition they are provided with slot openings for the admission of air, as shown at g' and h', said slot openings flaring downwardly and having bottom inclined walls for conducting any ashes passing into the openings down and off of the bars.

Where exceedingly long bearer bars are employed it is sometimes necessary or desirable to connect them together at an intermediate point in their length and this may be readily accomplished by forming tapering dove-tail seats I, as shown in Fig. 3, and extending a bar having a properly shaped end transversely across between the bearer bars, as shown in section at i in Fig. 1. So, too, in some instances it may be desirable to brace the bars A′ of the grid or frame of the tilting or dumping sections, and this may be accomplished by a transverse intermediate connection, such as shown in section at K in Fig. 11, although this will not ordinarily be found necessary where the dumping sections are of any reasonable dimensions.

The dumping or tilting sections may be operated in pairs or singly, one preferred arrangement being that shown in Fig. 1, where each section is provided with a downwardly extending working bar lug L, the lugs L of the two rear sections being connected by a link L′ and the latter pivotally connected with a working bar L^2, extending out to the front of the furnace, and pivotally connected with a handle stub L^3. The two forward sections are similarly connected with a second working bar L^4 extending out to the front of the furnace and adapted to be operated by a separate or the same handle stub as that of the rear section, it being preferred that the front and rear sections however be moved independently, whereby the fuel may be manipulated or raked off of two sections when the ashes are dumped therefrom, and then returned while the ashes are dumped from the other sections.

A grate embodving the construction herein set forth is highly advantageous from both the manufacturer's and user's points of view. The removable tops of each dumping section are rigid with respect to each other, and are of such dimension that the effect of growth is minimized and such growth as does occur does not appreciably change the ratio or relative proportion of the air inlet openings to the whole grate area, so that a uniform air supply can be maintained throughout all parts of the grate even after long continued and hard usage such as would practically render grates having removable tops with oppositely disposed edges practically inoperative for economical use with the fine fuel. The removable tops are easily and quickly removed and replaced should any of them become burnt out or broken, and they are so arranged as to effectually protect the framework from direct contact with the fire and so as to leave said framework exposed to the cooling influence of the incoming air, whereby it is found that the framework is rendered practically indestructible in the ordinary operations of the furnace.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having parallel bars and a series of removable tops rigidly mounted on each bar, the removable tops on adjacent bars having their proximate ends overlapped below the general level of the fuel supporting surface and spaced to form air admission openings between them inclined to the general plane of the grate.

2. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having parallel bars and a series of removable tops having air passages therethrough rigidly mounted on each bar, the removable tops on adjacent bars having their proximate ends overlapped below the general level of the fuel supporting surface and spaced to form air admission openings between them inclined to the general plane of the grate.

3. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having bars parallel with the axis of the section and a series of removable tops having air passages therethrough rigidly mounted upon each bar, the front and rear edges of each top being beveled respectively upwardly and downwardly and the tops on adjacent bars having their oppositely beveled ends overlapped and spaced apart to form air openings inclined to the plane of the fuel supporting surface.

4. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having a plurality of bars parallel with the axis of the section and said bars all having relatively small removable tops provided with air passages therethrough secured to corresponding sides thereof, said removable tops on adjacent bars being provided with

overlapping and underlapping edge portions respectively at their adjacent edges below the general plane of the fuel supporting surface.

5. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having a plurality of bars parallel with the axis of the section, all of said bars having seats on the same side, a series of removable tops having air passages therethrough carried by each bar and with the proximate ends of the tops on adjacent bars overlapped but spaced to form air openings inclined to the plane of the grate and said tops having downwardly tapering shanks mounted in the seats on the bar, and clamps and bolts for holding the shanks and tops in place.

6. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having a bar parallel with the axis of the grid, said bar having on one side projections with inclined edge surfaces forming seats and projections with inclined top and bottom surfaces, a series of removable tops having air passages therethrough and having downwardly extending tapered shanks seated in said seats, a clamp for each shank having recesses for the projections with inclined top and bottom faces, and bolts for securing said clamps and shanks in position on the bar.

7. A grate comprising a plurality of tilting sections, each section embodying a grid having a bar parallel with the axis of the section, said bar being provided with projections forming recessed seats in one side thereof, and projections at each side of said seats for retaining clamps in position, clamps having recesses for the reception of said last mentioned projections, removable tops having air passages therethrough resting on the upper edges of the bar and clamps and having downwardly extending shanks seated in said seats and bolts extending through the clamps, shanks and bar for holding the same together.

8. A grate comprising a plurality of tilting sections, each section embodying a rigid grid having a plurality of bars parallel with the axis of the grid, all of said bars having seats on the corresponding side thereof, and projections extending outwardly at intermediate points between said seats, a series of removable tops having air passages therethrough and having downwardly extending shanks mounted in said seats, the proximate ends of the removable tops being overlapped but spaced to form narrow air outlet openings between them inclined to the general plane of the grate, clamps having recesses for the reception of said projections on opposite sides of the seats, and bolts passing through the clamps, shanks and bars for holding the removable tops rigidly in position with relation to each other.

9. In a grate, the combination with a plurality of tilting sections embodying a rigid frame having journals at its opposite ends and removable tops having air passages therethrough rigidly mounted on said frame, of bearer bars having open bearings for said journals, caps for closing said bearings, removable tops inclosing and confining the caps and having end projections, and intermediate removable tops anchored to the bearer bars and having recesses for the reception of said end projections whereby the cap confining tops are held in position.

10. In a grate, the combination with a plurality of tilting sections embodying a rigid grid frame having journals at its opposite ends and removable tops having air passages therethrough rigidly mounted on said frame, of bearer bars having open bearings for said journals, caps for closing said bearings, removable tops having air passages therethrough inclosing and confining the caps and having end projections, and intermediate removable tops having air passages therethrough anchored to the bearer bars and having recesses for the reception of said end projections whereby the cap confining tops are held in position.

11. In a grate for fine fuel, the combination with the tilting sections embodying rigid grids having parallel bars and end journals and removable tops having air passages therethrough clamped to said bars with the proximate ends of the tops on adjacent bars overlapping but spaced apart, of bearer bars having open bearings for the grid journals, with upwardly tapering projections on opposite sides of said bearings, removable caps bridging the bearings to confine the journals therein, removable cap confining tops having air passages therethrough having bifurcated portions embracing the bearer bar on opposite sides of the bearing, and intermediate removable tops anchored to the bearer bar with interlocking projections and recesses between the cap confining and anchored tops for retaining the cap confining tops in position.

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