

May 19, 1931.

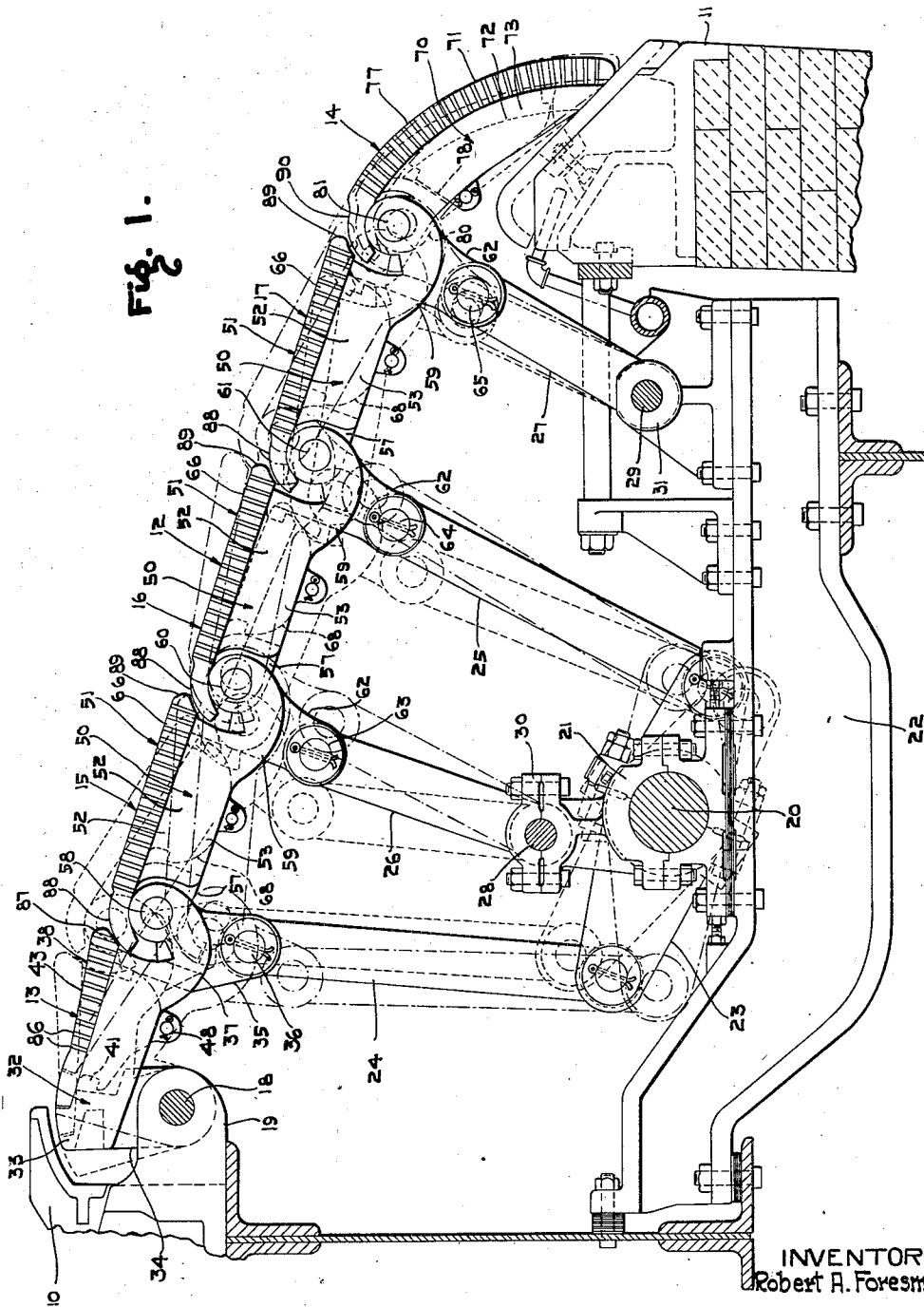
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1,805,618

STOKER

Original Filed Feb. 4, 1929

3 Sheets-Sheet 1



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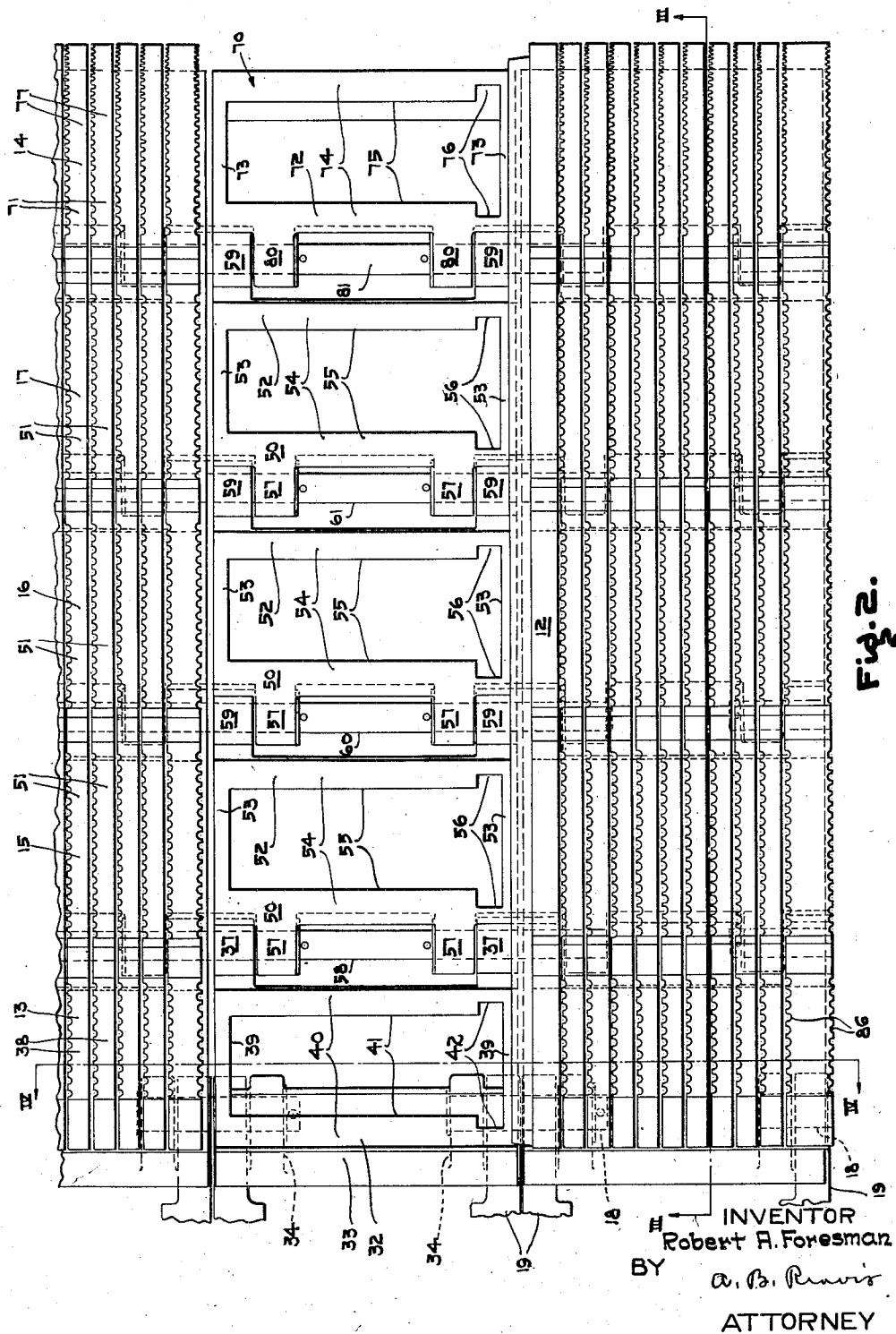
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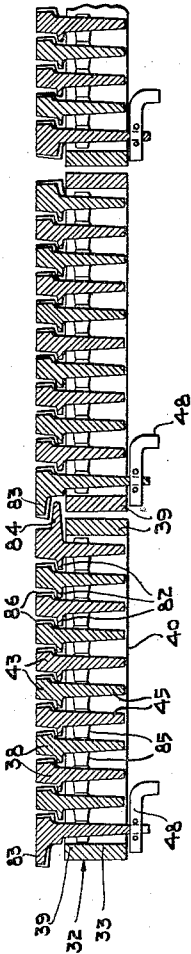


Fig. 4.

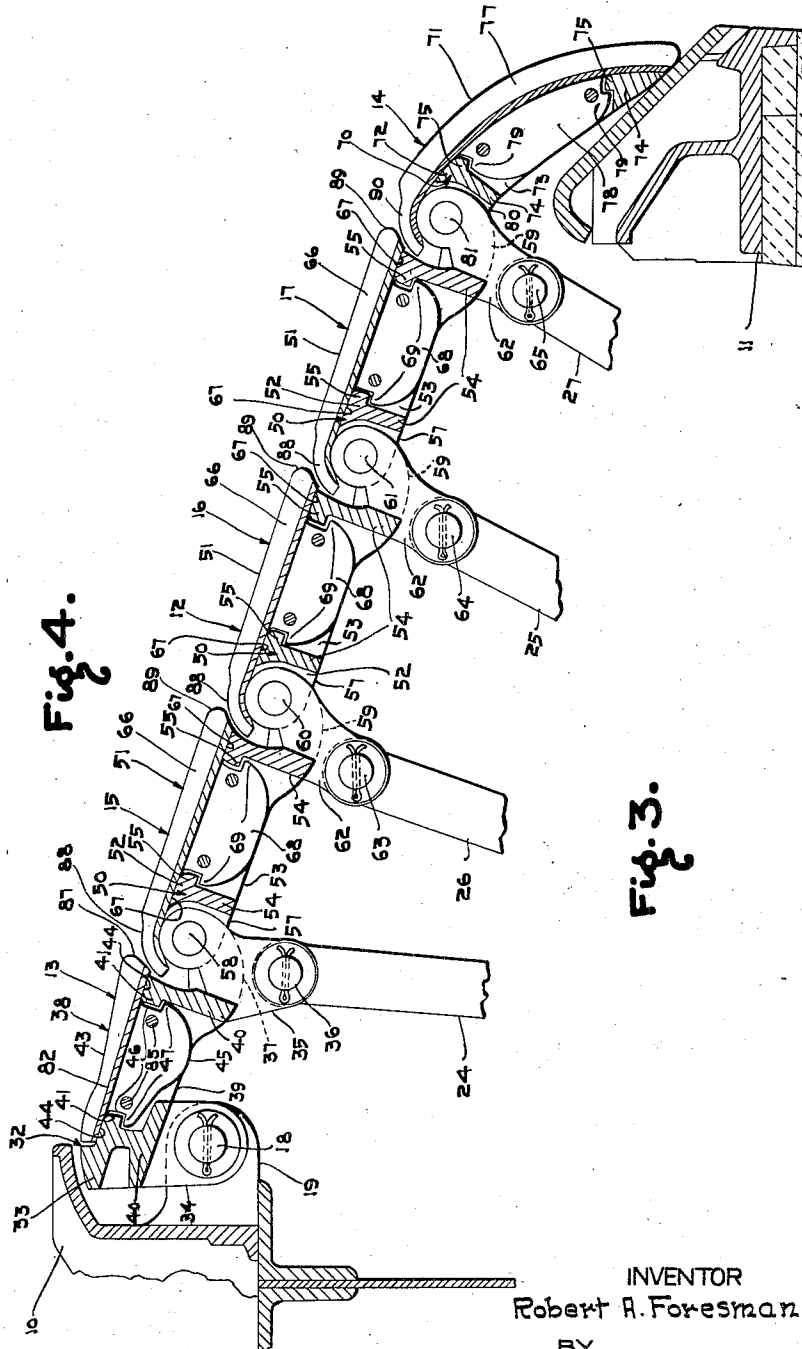


Fig. 3.

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STOKER

Original application filed February 4, 1929, Serial No. 337,445. Divided and this application filed April 7, 1930. Serial No. 442,358.

My invention relates to progressive feed stokers and more particularly to overfeed grates; the present application being a division of my copending application, Serial No. 337,445, filed February 4, 1929, entitled "Stoker" and assigned to the Westinghouse Electric & Manufacturing Company.

This invention has for an object to provide an improved form of overfeed grate which is so constructed as to provide, under all conditions of operation, a substantially unbroken fuel-supporting surface.

A further object is to provide a grate member for an overfeed grate of the character referred to which is of improved construction and arrangement of parts.

A still further object is to provide an improved form of grate bar which may be readily assembled and replaced in a grate member and is so constructed as to cooperate with similar grate bars to provide the unbroken fuel-supporting surface.

These and other objects are effected by my invention, as will be apparent from the following description and claims, taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a fragmentary, longitudinal sectional view of a progressive feed stoker showing my improved form of overfeed grate and the operating and supporting means therefor;

Fig. 2 is a fragmentary plan view of the construction shown in Fig. 1, the grate bars being removed from one of the series of grate frames for the purpose of clearness;

Fig. 3 is a longitudinal sectional view of the overfeed grate taken on the line III—III of Fig. 2; and,

Fig. 4 is a fragmentary, transverse sectional view taken on the line IV—IV of Fig. 2.

According to a preferred embodiment of my invention which is shown on the accompanying drawings, I provide a progressive feed overfeed grate comprising a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed. I provide means for pivotally anchoring the forward end of the

first grate member, considered in the direction of fuel feed, to a stationary support, and means for supporting the remaining grate members both for bodily movement in the direction of fuel feed and also for angular movement about axes extending transversely of the direction of fuel feed. Each of the grate members is of improved form and comprises a rectangular, hollow grate frame including side members disposed in the direction of fuel feed and end members connecting the side members and having ribs formed thereon; and a plurality of grate bars disposed longitudinally in each of the frames and having depending, longitudinally-extending web portions having locking portions formed on the ends thereof and engaging the ribs on the end elements. The grate bars are provided, at their ends, with projections which are arranged in overlapping relation with other projections on similar grate bars in adjacent frames. The grate bars are also provided with laterally-extending flange portions which overlap portions of adjacent parallel grate bars. These overlapping projections and lateral flange portions provide a substantially unbroken fuel-supporting surface. In addition, the grate bars may be readily assembled and replaced in the frames.

Referring now in detail to the construction illustrated, the reference numeral 10 indicates the lower discharge end of a conventional, downwardly-inclined, multiple-retort underfeed stoker, and the reference numeral 11 the front wall of a clinker grinder pit. Disposed between the discharge end of the underfeed section and the clinker pit, is a downwardly-inclined overfeed grate section 12 constructed and arranged to receive the burning material from the underfeed section, to provide an agitating unbroken support for the material during combustion, and lastly to positively move such material over its fuel supporting surface and deposit the solid products of combustion into the clinker pit.

The overfeed grate section 12 comprises a plurality of series of grate members. The several series are arranged in abutting side-by-side relation to one another. The grate

members forming each series are pivotally connected together in end-to-end relation and extend in the direction of fuel feed, i. e., they extend from the underfeed section to the clinker pit. The forward or first grate member of each series is indicated by the reference numeral 13, the rear or last grate member by the numeral 14, and the second, third and fourth or intermediate grate members by the numerals 15, 16 and 17, respectively.

The forward ends of the forward grate members 12 of the overfeed grate section are pivotally connected by pins 18 to brackets 19 carried by the underfeed section. The rear ends of the rear grate members 14 are slidably supported by the front wall of the clinker pit.

Driving and supporting means are provided for the intermediate portions of the overfeed grate section adjacent the pivotal connections between the several grate members. An oscillatory power shaft 20 is disposed transversely of and beneath the overfeed grate section and is mounted in suitable bearings 21 carried by supporting beams 22. Rocker arms 23 are keyed to the power shaft and the outer ends of the rocker arms are connected to the overfeed grate section adjacent some of the intermediate pivotal connections by means of driving links 24 and 25. The overfeed grate section is supported at the remaining intermediate pivotal connections by floating links 26 and 27 which are pivotally supported at their lower ends by shafts 28 and 29, respectively. The shafts 28 and 29 are respectively supported by bearings 30 and 31 carried, respectively, by the stationary housing of the bearing 21 and the beams 22.

As shown, the driving links 24 and 25 are connected to the overfeed grate section at alternate pivotal connections between the grate members, and the supporting links 26 and 27 are connected at the remaining pivotal connections. Oscillatory movement of the power shaft results in an up and down movement of the driving links, an oscillatory movement of the forward grate members 13 about their pivotal connection with the underfeed section and a combined oscillatory and reciprocatory movement of the remaining grate members. In Fig. 1, the dot lines indicate one extreme position of the grate members and the dot and dash line the other extreme position.

Each forward grate member includes an integrally formed frame structure 32 comprising a hollow rectangular body portion 33; a pair of spaced lugs 34 extending downwardly from the forward end of the body portion and having aligned openings for receiving the pivot pins 18; a pair of spaced lugs 35 extending downwardly from the rear end of the body portion and having aligned openings for receiving pivot pins 36 connecting the grate member with the upper end of the driving links 24; and a pair of spaced lugs 37 ex-

tending rearwardly from the rear end of the body portion. The forward grate member also includes a plurality of detachable grate bars 38 arranged in the body portion in side-by-side relation to one another and extending longitudinally in the direction of fuel feed.

The hollow body portion 33 of the forward grate member comprises spaced parallel side elements 39 extending longitudinally in the direction of fuel feed, and end elements 40 connecting the ends of the side elements 39. Ribs 41 are formed integral with the inner side of the end elements 40. The ribs 41 do not extend for the entire length of the end elements, but stop short of one side element to provide openings 42 through which the grate bars 38 may be inserted.

Each of the grate bars 38 is an integrally formed piece and includes a fuel supporting head portion 43 having seating faces 44 on the underside thereof, adjacent the ends, for engaging the upper surfaces of the end elements. The grate bar 38 also includes a depending longitudinally-extending web portion 45 having undercut recesses 46 in the ends thereof. The recesses 46 define locking projections 47 which engage the underside of the ribs 41 on the end elements 40 for holding the grate bars within the frame.

The grate bars are assembled within the body portion by first inserting the bars within the openings 42 and then sliding the bars along the ribs 41. All of the grate bars, with the exception of the last to be inserted, are held within the frame by the cooperation between the locking projections 47 and ribs 41. The last grate bar to be inserted is secured in position within the openings 42 by means of a locking pin 48 extending through an opening in the web portion 45 and beneath the underside of the adjacent side element 39 and the web of the adjacent grate bar.

The intermediate grate members 15, 16 and 17 of each series are identical in construction, so for the purposes of brevity, only the grate member 15 is described in detail, and the same reference characters are used to designate the detail elements of the grate members 16 and 17 as are used to designate the corresponding elements in the grate member 15.

Like the forward grate member 13, the intermediate grate member 15 includes an integrally formed frame structure 50 and grate bars 51 detachably secured within the frame structure. The frame structure 50 includes a rectangular hollow body portion 52 having side elements 53 extending longitudinally in the direction of the fuel feed and end elements 54 connecting the side elements and having integrally formed ribs 55 formed on the inner sides of the end elements and stopping short of one side element 53 to provide openings 56 for receiving the grate bars 51.

The frame structure 50 also includes a pair of forwardly-extending lugs 57 having

aligned openings therein for receiving pivot pins 58, which latter also pass through aligned openings formed in the lugs 37 on the forward grate member 13 and thereby provide a pivotal connection between the forward grate member and the intermediate grate member.

The frame structure 50 also includes a pair of rearwardly-extending lugs 59 having aligned openings therein for receiving pivot pins 60, which latter also pass through the aligned openings formed in the pair of spaced lugs 57 extending from the forward end of the intermediate grate member 16. The pivot pins 60 provide a pivotal connection between the intermediate grate members 15 and 16. In a like manner, the adjacent ends of the grate members 16 and 17 are pivotally connected, a pin 61 serving to connect the cooperating pairs of lugs extending from the adjacent ends of those grate members.

The frame structure 50 of the intermediate grate member 15 is also provided with a pair of lugs 62 extending downwardly from the rear end thereof which are provided with openings for receiving pivot pins 63 for connecting the grate member 15 with the upper end of the supporting link 26. The grate member 16 is pivotally connected to the upper ends of the driving links 25 by pins 64 extending through openings in the lugs 62 of such grate members and openings provided in the links 25. The grate member 17 is connected to the supporting link 27 by pivot pins 65 passing through the lugs of that grate member and the end of the link.

The grate bars 51 are arranged in side-by-side relation within the body portion 52 of their respective frames 50, and extend longitudinally in the direction of the fuel feed. Each grate bar 51 comprises a longitudinally-extending head portion 66 having seating faces 67 formed on the under surface thereof for engaging the end elements 54 and a downwardly-extending web portion 68 having locking projections 69 formed in the ends thereof for engaging the under surfaces of the ribs 55. The grate bars 51 are assembled and held within the body portion in the same manner as the grate bars 38 of the grate member 13.

The last grate member 14 of each series comprises a hollow integrally formed frame structure 70, and grate bars 71 detachably secured within the frame structure. Like that of the previously described grate members, the frame structure 70 includes a rectangular hollow body portion 72 having longitudinally arranged side elements 73, and end elements 74 connecting the ends of the side elements and having ribs 75 formed of the inner side thereof stopping short of one side element to provide openings 76 for receiving the grate bars 71. The grate bars 71 comprise longitudinally extending head elements 77

and web elements 78 having locking projections 79 in the ends thereof, and are assembled and secured in the body portions in a manner similar to that of the previously described grate bars and body portions.

The frame structure 70 is provided at its forward end with a pair of forwardly extending lugs 80 having aligned openings therein receiving pivot pins 81, which latter also pass through aligned openings in the lugs 59 of the grate member 17 and thereby serve to pivotally connect the last grate member 14 to the grate member 17. The rear end of the last grate member is provided with a relatively smooth under surface which slidably engages the upper inclined surface of the front wall 11 of the clinker pit.

Referring to Fig. 4, it is to be observed that all of the grate bars 38 of the frame 13, with the exception of the left-hand or last grate bar to be inserted within the frame are provided at one side with lateral flange portions 82 which extend longitudinally for the entire length of the bar and laterally beneath the head portion 43 of an adjacent grate bar, the purpose of which is to provide a substantially unbroken fuel supporting surface and thereby eliminate the sifting of the fine coal and ash. As shown, the last grate member to be inserted is provided at its left-hand side with a lateral projection or flange 83, the upper surface of which is flush with the head portion thereof. The right-hand or first grate member to be inserted is provided on the side opposite the flange 82, with a second flange or projection 84 which extends beneath the flange 83 on the last grate bar of an adjacent frame to effect the unbroken surface. All of the grate bars 38 are also provided with frustro-conical-shaped projections 85 which serve to maintain the bars in their proper relative position. The head portions of the grate bars are also provided with vertical grooves 86 to permit air for supporting combustion to pass therethrough.

The grate bars 51 of the intermediate grate members 15, 16 and 17 and the bars 71 of the last grate member 14 are also provided with flange portions, projections and grooves which are similar in construction to the flange portions 82, 83 and 84, projections 85 and grooves 86 of the grate bars 38. A detail showing of these elements on the bars 71 and 77 is considered unnecessary.

Referring now to Figs. 1 and 3, it is to be observed that the bars 38 of the grate member 13 have rearwardly extending projections 87; the bars 51 of the grate members 15, 16 and 17 are provided at their forward ends with arcuate-shaped projections 88 and at their rear ends with projections 89; and the bars 71 of the last grate member are provided with forwardly extending arcuate-shaped projections 90. The construction of the several projections is such that when the grate

bars are in position within their respective frames, the projections 87 on the rear of the bars 38 overlap the arcuate-shaped projections 88 on the forward end of the bars 51 of the member 15; the projections 89 on the rear of the bars 51 of the member 15 overlap the arcuate-shaped projections 88 on the bars 51 of the member 16; the projections 89 on the rear of the bars 51 of the member 16 overlap the arcuate-shaped projections 89 of the bars 51 of the member 17; and the projections 89 on the rear of the bars 51 of the member 17 overlap the arcuate-shaped projections 90 of the member 14. The overlapping of the projections on the adjacent ends of the grate bars provide a novel means for maintaining a substantially unbroken fuel-supporting surface even though there be relative movement between the frames.

From the above description, it will be readily seen that I have provided a novel form of overfeed grate section, the component parts of which may be easily manufactured, are of durable construction, and may be readily renewed at a low cost. Furthermore, due to the particular construction of the grate frames and the bars fitting within the frames, a uniform air distribution is provided over the entire overfeed grate section. Also, the construction and arrangement of the frames and bars provide for the maintenance at all times of a substantially unbroken fuel-supporting surface, thereby eliminating, almost entirely, the sifting of the fine coal and ash through the grate.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In combustion apparatus, a progressive feed overfeed grate comprising, in combination, a series of rectangular-shaped grate frames pivotally connected together in end-to-end relation and extending in the direction of fuel feed; and grate bars detachably secured within the grate frames and arranged longitudinally in the direction of fuel feed; said grate bars having projecting portions at the ends thereof overlapping with one another to provide a substantially unbroken, fuel-supporting surface.

2. In combustion apparatus, a progressive-feed overfeed grate comprising, in combination, a series of rectangular-shaped grate frames pivotally connected together in end-to-end relation and extending in the direction of fuel feed; grate bars detachably secured within the grate frames and arranged longitudinally in the direction of fuel feed;

said grate bars having projecting portions at the ends thereof overlapping with one another to provide an unbroken, fuel-supporting surface; and pairs of spaced lugs extending downwardly from some of the grate frames for connecting with supporting and operating means.

3. In combustion apparatus, a progressive feed overfeed grate comprising, in combination, a series of rectangular-shaped grate frames pivotally connected together in end-to-end relation and extending in the direction of fuel feed; grate bars detachably secured within the grate frames and arranged longitudinally in the direction of fuel feed; said grate bars having projecting portions at the ends thereof overlapping with one another to provide an unbroken, fuel-supporting surface; pairs of spaced lugs extending downwardly from some of the grate frames for pivotal connection with supporting and operating means; a pair of spaced lugs extending downwardly from the forward end of the first member of the series considered in the direction of fuel feed for pivotally connecting the grate to a stationary support; the last grate member of the series, considered in the direction of fuel feed, having a relatively smooth under surface permitting sliding engagement with a stationary support.

4. In a progressive feed overfeed grate, a grate member adapted to form one of a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed, and comprising, in combination, a hollow rectangular grate frame including side elements, end elements connecting the side elements, rib means formed on the end elements, and a pair of spaced lugs extending from one end of the frame in the direction of fuel feed and having openings therein for the purpose of receiving pivot pins for pivotally connecting the frame to an adjacent frame; and a plurality of grate bars disposed longitudinally within the frame and including longitudinally-arranged web elements having locking portions in the ends thereof and engaging the ribs on the end elements of the grate frame.

5. In a progressive feed overfeed grate, a grate frame adapted to form a part of one of a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed, and comprising, in combination, a hollow rectangular body portion including a pair of side elements disposed in spaced relation and arranged longitudinally in the direction of fuel feed and a pair of spaced end elements connecting the side elements; rib means formed on the end elements for detachably securing grate bars within the frame; and a pair of spaced lugs extending from one end of the body portion in the direction of

fuel feed and having openings therein for the purpose of receiving pivot pins for pivotally connecting such frame to an adjacent frame.

6. In a progressive feed overfeed grate, a grate frame adapted to form a part of one of a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed, and comprising, in combination, a hollow rectangular body portion including a pair of spaced side elements arranged longitudinally in the direction of fuel feed and a pair of spaced end elements connecting the side elements; rib means formed on the end elements for detachably securing grate bars within the frame; a pair of spaced lugs extending from one end of the body portion in the direction of fuel feed and having openings therein for the purpose of receiving pivot pins for connecting such frame to an adjacent frame; and a second pair of spaced lugs extending downwardly from one end of the body portion and having openings formed therein adapted to receive pivot pins.

7. In a progressive feed overfeed grate, a grate frame adapted to form a part of one of a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed, and comprising, in combination, a hollow rectangular body portion including a pair of spaced side elements arranged longitudinally in the direction of fuel feed and a pair of spaced end elements connecting the side elements; rib means formed on the end elements for detachably securing grate bars within the frame; a pair of spaced lugs extending from one end of the body portion in the direction of fuel feed and having openings for the purpose of receiving pivot pins for pivotally connecting such frame to an adjacent frame; and a pair of spaced lugs extending from the other end of the body portion for pivotally connecting such frame to another adjacent grate frame.

8. In a progressive feed overfeed grate, a grate frame adapted to form a part of one of a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed, and comprising, in combination, a hollow rectangular body portion including a pair of spaced side elements arranged longitudinally in the direction of fuel feed and a pair of spaced end elements connecting the side elements; rib means formed on the end elements for detachably securing grate bars within the frame; a pair of spaced lugs extending from one end of the body portion in the direction of fuel feed and having openings therein for the purpose of receiving pivot pins for connecting such frame to an adjacent frame; a pair of spaced lugs extending from the

other end of the body portion for pivotally connecting such element to another adjacent grate frame; and a pair of spaced lugs extending downwardly from one end of the body portion and having openings therein adapted to receive pivot pins.

9. In a progressive feed overfeed grate, a grate frame adapted to form a part of one of a series of grate members pivotally connected together in end-to-end relation and extending in the direction of fuel feed, and comprising, in combination, a hollow rectangular body portion including a pair of spaced side elements arranged longitudinally in the direction of fuel feed and a pair of spaced end elements connecting the side elements; a pair of spaced lugs extending from one end of the body portion and having openings therein for receiving pivot pins for pivotally connecting such frame to an adjacent grate frame; a pair of spaced lugs extending downwardly from the same end of the body portion as the aforementioned lugs and having spaced openings for pivotal connection with an operating member; and a pair of spaced lugs extending downwardly from the other end of the body portion and having openings for pivotal connection with a stationary support.

10. In a progressive feed overfeed grate of the type comprising a series of grate frames pivotally connected together in end-to-end relation and extending in the direction of the fuel feed, a grate bar adapted to be detachably secured within a grate frame in longitudinal relation therewith and adapted in conjunction with other grate bars disposed in side-by-side relation therewith in the same frame and other grate bars in adjacent frames of the series to form a substantially unbroken fuel-supporting surface; the grate bar comprising, in combination, a longitudinally-extending, fuel-supporting head element having a projection at at least one end thereof for the purpose of being arranged in overlapping relation with a grate bar of an adjacent frame of the series, a flange portion extending laterally from one side of the head portion for the length thereof and adapted to be disposed in overlapping relation with portions of an adjacent grate bar of the same frame, and a depending, longitudinally-extending web element having locking portions at the ends thereof for cooperation with portions of the grate frame to hold the grate bar in position.

11. In a progressive feed overfeed grate of the type comprising a series of grate frames pivotally connected together in end-to-end relation and extending in the direction of the fuel feed, a grate bar adapted to be detachably secured within a frame in longitudinal relation therewith and adapted in conjunction with other grate bars disposed in side-by-side relation therewith in the same frame and other grate bars in adjacent frames of

the series to form a substantially unbroken fuel-supporting surface; the grate bar comprising in combination a longitudinally-extending, fuel-supporting head element having a projection at at least one end thereof for the purpose of being arranged in overlapping relation with a grate bar of an adjacent frame of the series, a flange portion extending laterally from one side of the head portion for the length thereof and adapted to extend beneath a projecting portion of an adjacent grate bar of the same frame, the other side of the grate bar having a plurality of grooves formed therein for the passage of air to the fuel bed, and a depending, longitudinally-extending web element having locking portions at the ends thereof for cooperation with portions of the grate frame to hold the grate bar in position.

12. In a progressive feed overfeed grate of the type comprising a series of grate frames pivotally connected together in end-to-end relation and extending in the direction of the fuel feed, a grate bar adapted to be detachably secured within a grate frame in longitudinal relation therewith and adapted in conjunction with other grate bars disposed in side-by-side relation therewith in the same frame and other grate bars in adjacent frames of the series to form a substantially unbroken, fuel-supporting surface; the grate bar comprising, in combination, a longitudinally-extending, fuel-supporting head element having a projection at at least one end thereof for the purpose of being arranged in overlapping relation with a grate bar of an adjacent frame of the series, a flange portion extending laterally from one side of the head portion for the length thereof and adapted to extend beneath a projecting portion of an adjacent grate bar of the same frame, the other side of the grate bar having a plurality of grooves formed therein for the passage of air to the fuel bed, a depending, longitudinally-extending web element having locking portions at the ends thereof for cooperation with portions of its respective grate frame to hold the grate bar in position, and spacer projections extending laterally from the web element for maintaining the grate bar in proper relation with respect to adjacent grate bars.

In testimony whereof, I have hereunto subscribed my name this second day of April, 1930.

ROBERT A. FORESMAN.