

(No Model.)

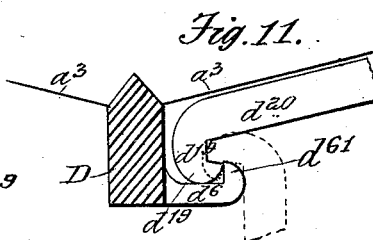
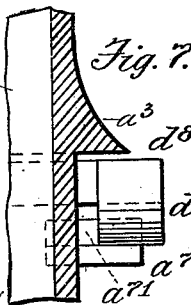
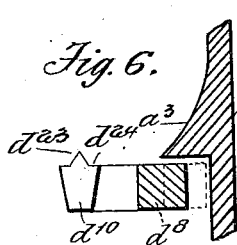
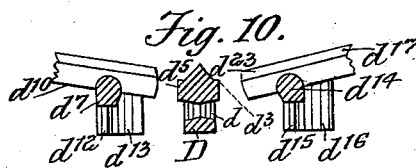
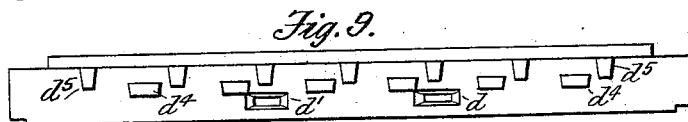
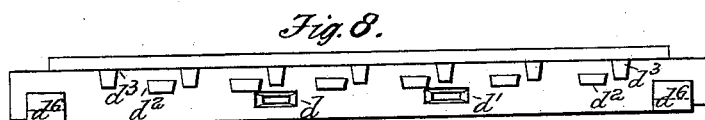
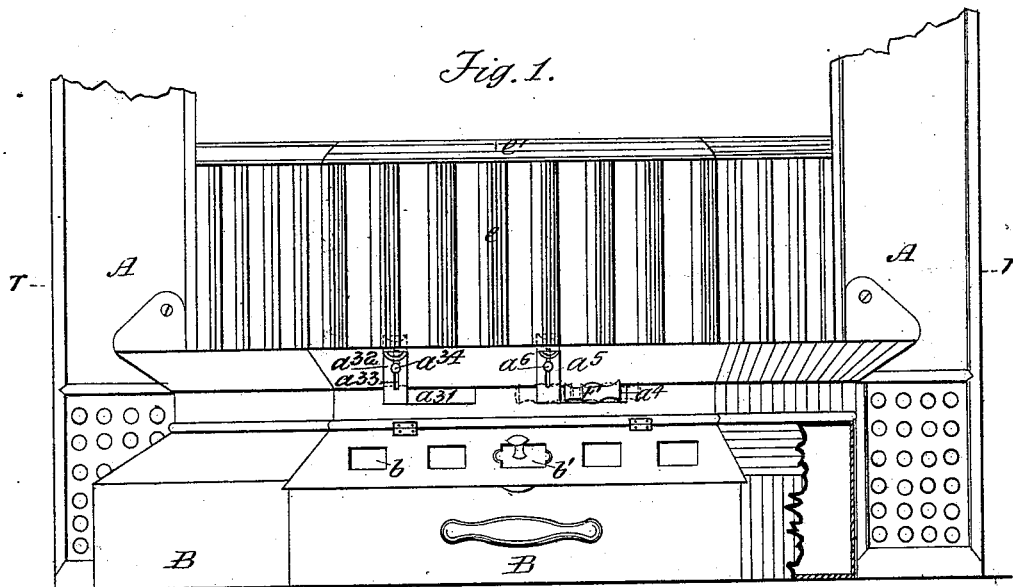
3 Sheets—Sheet 1.

E. J. STORY.

FIRE GRATE.

No. 346,830.

Patented Aug. 3, 1886.



WITNESSES

Henry W. Cobb
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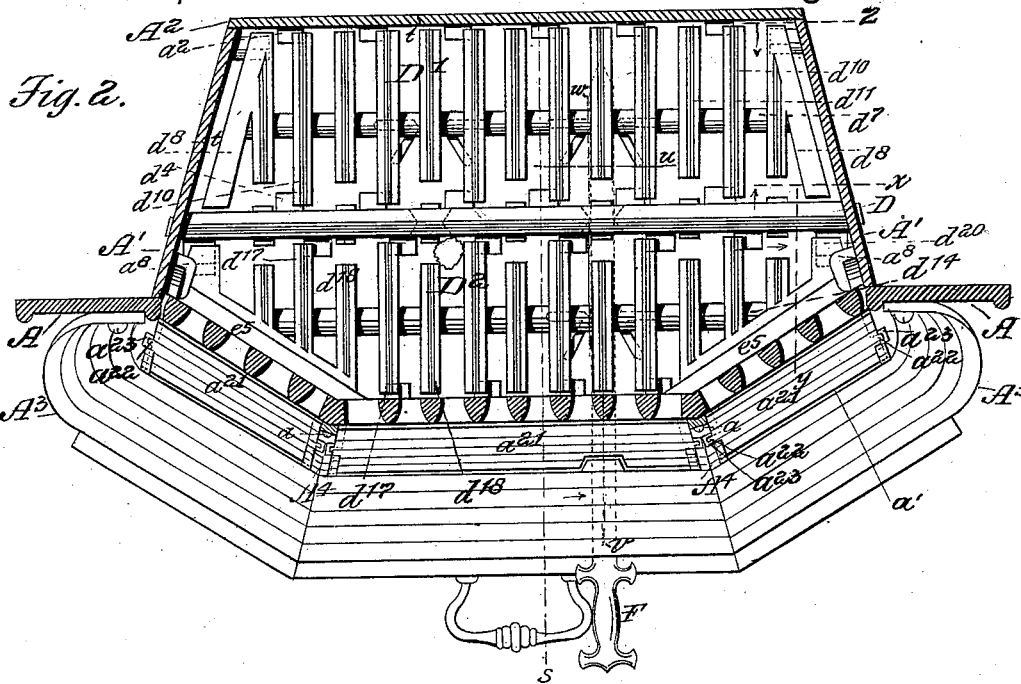
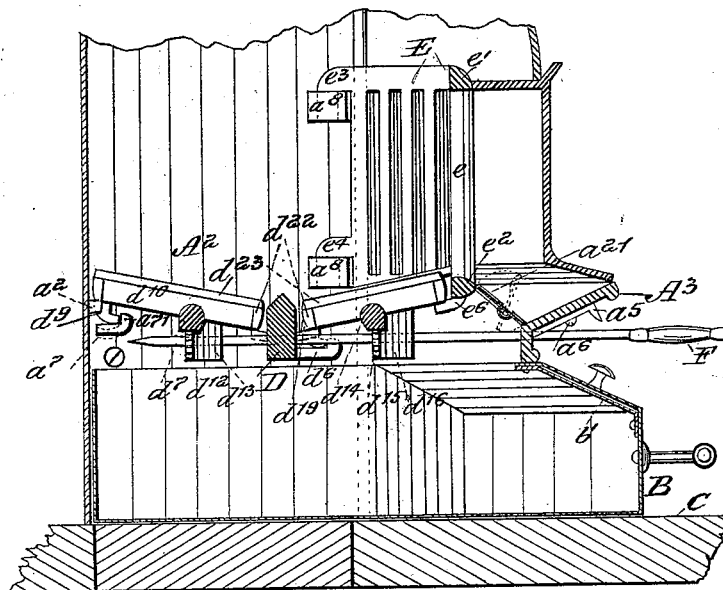


Fig. 3.



WITNESSES

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Fig. 4.

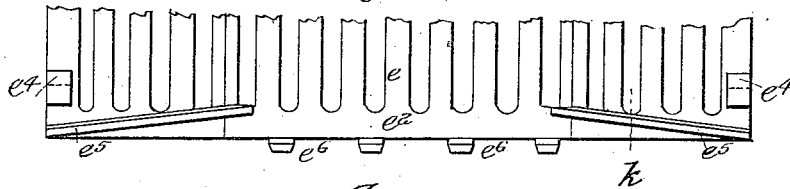


Fig. 5.

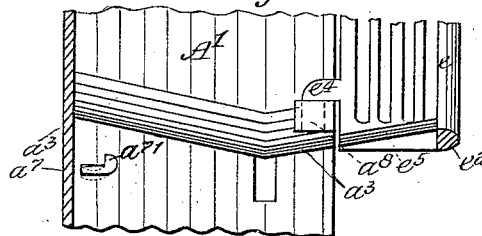


Fig. 19.

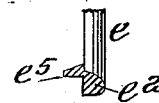


Fig. 12.

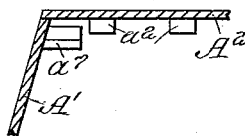


Fig. 13.

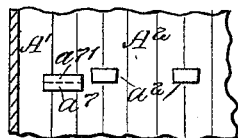


Fig. 14. Fig. 15. Fig. 16.

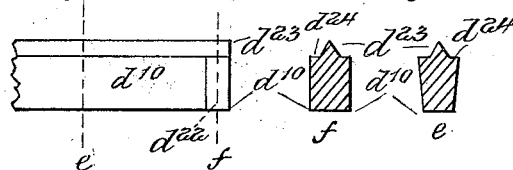


Fig. 17.

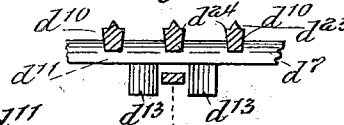


Fig. 20.

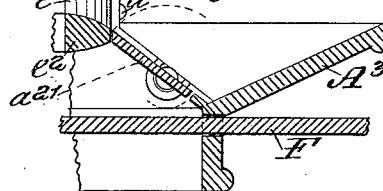
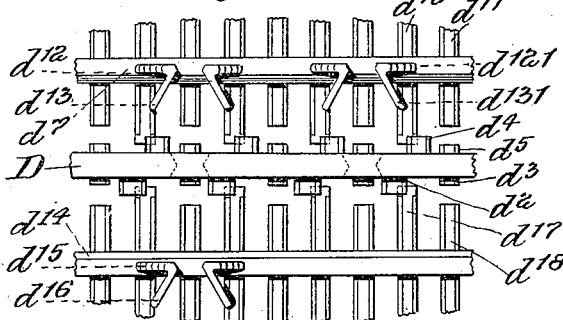


Fig. 18.



WITNESSES

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UNITED STATES PATENT OFFICE.

EPHRAIM J. STORY, OF WASHINGTON, DISTRICT OF COLUMBIA.

FIRE-GRATE.

SPECIFICATION forming part of Letters Patent No. 346,830, dated August 3, 1886.

Application filed June 3, 1885. Serial No. 167,504. (No model.)

To all whom it may concern:

Be it known that I, EPHRAIM J. STORY, a citizen of the United States, residing in Washington, in the District of Columbia, have invented certain new and useful Improvements in Fire-Grates, of which the following is a description.

The invention relates to that class of fire-grates which are adapted to be agitated in a horizontal plane and to be dumped, and which are intended mainly for domestic use, being applicable in fire-places, open or closed stoves, and air-heating furnaces, but being specially advantageous when employed in the two former classes of heaters.

The invention consists in certain novel elements and combinations of elements in a grate of the class above indicated, which will first be described in connection with the accompanying drawings, which constitute a part of the specification, and then distinctly pointed out in the claims.

In the drawings, Figure 1 is a front elevation, a portion being broken out, of an open or fire-place stove which is provided with my improved fire-grate. Fig. 2 is a top plan view, the section being taken on the line *r* of Fig. 1. Fig. 3 is a vertical central transverse section on the line *s* of Fig. 2. Fig. 4 is a rear elevation of a fragment of the front or basket portion of the grate detached. Fig. 5 is an interior end elevation, the grate-sections being removed, of the casing or wall of the stove and the corresponding vertical or basket portion of the grate. Fig. 6 is a vertical section, drawn to an enlarged scale, on the line *x* of Fig. 2, looking toward the rear. Fig. 7 is a vertical section on the line *z* of Fig. 2, drawn to an enlarged scale, and looking toward the front. Fig. 8 is a front elevation of the main longitudinal bearing-bar detached. Fig. 9 is a rear elevation of the main longitudinal bearing-bar detached. Fig. 10 is a vertical transverse section on the line *w* of Fig. 2, looking toward the right. Fig. 11 is a partial vertical section on the line *y* of Fig. 2, looking toward the right. Fig. 12 is a fragment, in horizontal section, of the left rear portion of the shell of the stove, as indicated at *t t* in Fig. 2. Fig. 13 is an elevation of a portion of the shell of the stove, the line of section being indicated at *t t* in Fig. 2. Fig. 14 is a side elevation of a por-

tion of one of the transverse bars. Fig. 15 is a vertical transverse section on the line *f* of Fig. 14. Fig. 16 is a vertical transverse section on the line *e* of Fig. 14. Fig. 17 is a vertical section on the line *u* of Fig. 2. Fig. 18 is a bottom plan view of the central portion of the grate. Fig. 19 is a vertical section on the line *k* of Fig. 4. Fig. 20 is a fragmentary section on the line *v* of Fig. 2, drawn to an enlarged scale.

In this illustration of the invention the grate is represented in connection with an air-heating fire-place stove, *A A* being the front or face plates, *A' A'* the flaring end plates, *A²* the rear or back plate, and *A³* the supporting-rail at the front thereof.

B is the ash-pan, which is of a height to adapt it to close the space between the lower extremity of the supporting-rail and the surface of the hearth *C*, and of a horizontal area corresponding to the interior horizontal dimensions of the stove, but projecting beyond the same at the front in the manner shown.

In the upper front inclined portion of the ash-pan are air-inlet openings *b*, which are controlled by a register, *b'*.

A⁴ are arms which are formed with the rear portion of the supporting-rail *A³*, each of which is by its rear extremity connected by bolt *a* or other suitable means to the lower part of the vertical front or basket portion, *E*, of the grate. The spaces *a'* between the supporting-rail *A³* and the basket-section *E* of the grate are closed by eccentrically-pivoted valves *a²¹*, which are weighted in their upper portion, to insure certain closure and close contact of the valve with the coincident portion of the grate-front *E*. The supporting-rail *A³* is by its ends suitably secured to the front or face plates, *A*, of the stove, and this supporting-rail is, in its vertical lower portion pierced with longitudinal horizontal openings *a³¹* and *a⁴*, to receive an operating-lever, *F*, while upon the under or exterior portion of its inclined face it is provided with a stop, *a⁵*, which is in turn provided with a slot, *a⁶*, to receive a securing and guiding lug, *a⁷*, which projects from the face of the supporting-rail.

The end plates, *A' A'*, of the stove are pierced or recessed, to receive the squared ends of a central longitudinal supporting-bar

D, the main portion of which is in transverse section of the configuration represented in Fig. 3. In its lower portion the bar D is provided with horizontal transverse perforations d d' , to receive the operating-lever F, and it is further provided with front supporting lugs, d^2 , front agitating-fingers or short bars, d^3 , rear supporting-lugs, d^4 , rear agitating-fingers or short bars, d^5 , and front end supporting-lugs, d^6 , which have upturned hooks or engaging terminals d^{61} . The perforations d and d' in the bar D are made horizontally flaring at each end from the center toward the front and toward the rear, to facilitate the insertion and also to facilitate the operation of the lever F within the same.

The rear section, D', of the grate consists of a longitudinal web or connecting-bar, d' , two obliquely-arranged end bars, d^8 d^9 , each of which is provided with a bottom engaging-hook, d^9 , a series of transverse bars, d^{10} , an alternating series of transverse bars, d^{11} , bottom lugs, d^{12} d^{13} , and guides or guide-lugs d^{131} d^{13} . The bottom hooks, d^9 , of the end bars, d^8 , of the rear grate-section, D', engage with the hooked portion a^{11} of the supporting-lugs a' , which are formed with or are attached to the end plates, A'. A horizontally-arranged series of lugs, a^2 , which project from the interior surface of the back plate, A², of the stove, are coincident with the lugs d^1 upon the vertical rear face of the central longitudinal bar, D, and serve, in connection therewith, to support the transverse bars d^{10} when the section is adjusted toward the left.

The basket portion or front E of the grate consists of the horizontal bars or webs e' and e'' , the vertical bars e , upper and lower lugs, e^3 and e^4 , which engage eyes a^8 a^9 upon the end plates, A', inclined overhanging flanges e^5 e^6 , and a series of longitudinally-arranged supporting-lugs, e^6 , which are coincident with the supporting-lugs d^7 upon the vertical front surface of the central longitudinal bar, D.

The front section, D², of the grate consists of a longitudinal web or connecting-bar, d^{14} , a single pair of depending lugs, d^{15} , a corresponding pair of guide-lugs, d^{16} , a series of transverse bars, d^{17} , a series of transverse bars, d^{18} , which are arranged in alternation with the bars d^{17} and short end bars, d^{20} , which are provided with downwardly-extending bottom hooks, d^{19} .

The end plates, A', of the stove are each formed with a projection, a^3 , the upper portion of which is of a shelving form—that is, inwardly and downwardly inclined, substantially as shown in Figs. 5, 6, and 11, while the lower portion or bottom surface is perpendicular to the vertical face of the end plate. The end plates, A', are each further provided with a supporting-lug, a^7 , Figs. 3, 5, 7, 12, and 13, which, upon its front extremity, has an upturned hook, a^{71} . This supporting-lug may be made separate from the plate and connected thereto by any suitable means; but I prefer to cast them together. The transverse bars

d^{10} , d^{11} , d^{17} , and d^{18} are, in their main portion, made slightly tapering from top to bottom, as seen in Figs. 14, 16, 17, and 18, and upon their flat upper surface, d^{24} , they are provided with a projection, d^{23} , which extends from end to end of the bar, and in transverse section is of the pyramidal or Λ -shaped form seen in Figs. 15, 16, and 17. The longer transverse bars d^{10} and d^{17} are, however, at their ends of the rectangular form best seen in Fig. 15.

Coincident with the slot a^{31} in the vertical portion of the supporting-rail A³ is an adjustable stop, a^{32} , which is provided with a longitudinal slot, a^{33} , which receives a securing and guiding lug, a^{34} , which projects from the lower surface of the inclined or chute portion of the supporting-rail. The valves a^{21} have end journals, a^{22} , by which they are pivotally supported in bearings a^{23} in the supporting-rail A³, and in the arms A⁴ thereof.

The operation of the grate and its adjuncts will be apparent in the main from the drawings, in connection with the foregoing description of the parts. It will be seen that under the construction shown in Figs. 1, 2, and 3, if ashes or cinders fall upon the front inwardly and downwardly inclined portion of the supporting-rail A³, they will be carried to the valved openings a' , through which they will be discharged into the ash-pan, and that the openings a' will then be instantly closed through the automatic operation of the counterweighted valves a^{21} . As seen in Figs. 2, 3, and 11, each of the two grate-sections D' and D² has its bearings at the rear, so that when the section is dumped the discharge is toward the front. As seen in Figs. 7 and 11, the vertical extent of the bar d^8 and its hook, and of the bar d^{20} and its hook, is but slightly less than the distance between the horizontal upper surface of the supporting-lug a^7 and the lower surface of the projection a^3 , and between the upper surface of the lug d^6 and the lower surface of the projection a^3 , so that when the sections have been placed in position to be supplied with fuel and to be reciprocated the upper surface of the bars d^8 and d^{20} will be so near to the lower surface of the overhanging projection a^3 that no portion of the contents of the fuel-chamber can find its way between the ends of the sections and the face of the end plate. This construction secures a pivotal bearing, while it obviates the necessity for a pivot, and it prevents the removal of the section, even when in its dumped position, until the same has been lifted from its bearing behind the upturned hook of the supporting-lug. The overhanging projections e^5 upon the front of the grate are, as seen in Figs. 4 and 5, coincident with the front inclined portion of the projection a^3 upon the end plates, A', and this projection e^5 serves, as the projection a^3 does, to prevent obstruction of the grate by clinkers or coals, which otherwise might find lodgment at the ends of the grate-sections. Under the described construction, which provides the pivotal bearings at the rear, so that each grate-

section is dumped toward the front, the ash-pan may readily be drawn out, while the grate-sections are still in their dumped position, without obstruction through contact with the sections. Through the provision of the fixed independent longitudinal bar D, a fulcrum is afforded for the lever F, so that the sections may be reciprocated together, or each may be agitated separately. When the operating-lever F is in the position indicated in Figs. 2 and 3, its movement will agitate both of the grate-sections. If, then, it be desired to agitate the front section only, the lever will be withdrawn so far that its point shall be clear of the engaging-lugs d^{12} . If, then, it be desired to agitate the rear section only, the lever F will be wholly withdrawn from its position, as seen in Figs. 2 and 3, and will be inserted through the horizontal slot a^3 in the supporting-rail and between the engaging-lugs d^{121} . The connecting bar or web d^{14} having no engaging-lugs upon its left extremity, the operating-lever will in this position agitate the rear grate-section only. If it be desired to dump the rear section only of the grate, the sliding stop a^5 will be moved inward until its lower extremity passes into the slot a^4 , partially closing the same. In this position the stop will prevent the lever F from being moved so far to the left as to displace the front transverse bars from their supporting-lugs, and the operating-lever may then be withdrawn from its position, as seen in Figs. 1, 2, and 3, and applied through the slot a^3 between the lugs d^{121} d^{121} of the rear grate-section. The adjustable stop a^2 being then withdrawn from engagement with its slot a^1 , the outer end of the lever is moved to the left extremity of the slot, and this movement causes the transverse bars to pass beyond the ends of their supporting-lugs a^2 and d^1 , thus permitting the contents of the section to be discharged. In an analogous manner the front grate-section may be dumped, while the rear section remains undisturbed. The stop a^2 being adjusted in its inner position, the stop a^5 being moved outwardly, and the outer end of the operating-lever being moved from its position, as indicated in Figs. 1, 2, and 3, to the left extremity of the slot a^4 , material resting upon the section will be precipitated into the ash-pan. In reciprocating the grate-sections the larger pieces of clinker will be impelled by the inclination of the sections toward the central longitudinal bar. If too large to pass through the openings between the sections on the one side and the longitudinal bar and its fingers on the other side, they will be engaged by these parts in the manner indicated in Fig. 2, and in this position will be subjected to their disintegrating action until they have become so far diminished in dimensions as to permit them to pass through the opening and fall into the receptacle below. It will be noted that the bearing-lugs d^2 and d^4 upon the central longitudinal bar, the bearing-lugs a^2 upon the back plate of the stove, and the lugs d^6 upon the lower rear face of the front

or basket portion of the grate are all at their ends slightly diminished from the top downwardly. When, in the movement of the grate-sections, the transverse bars, which engage with the lugs, are passed along the top surface of the same in the operation of dumping the contents of the fuel-chamber into the space below, the squared ends d^{22} of such transverse bars will pass downwardly in a direct line as soon as the extremity of the lug has been cleared, whereas it is manifest that if the ends, like the main body, were tapered from the top downwardly, the tapered surface would continue to engage with the end of the lug along the entire vertical extent of the grate-bar. Through the provision of the free open space between the supporting-rail and the lower portion of the grate-front, and the outward projection of the ash-pan to a point a considerable distance in advance of such grate-front, a free automatic discharge into the ash-pan of clinkers and other refuse which may fall upon the inclined portion of the supporting-rail is insured.

As will be apparent from the drawings, the front guide-lugs serve to direct the operating-lever to the opening between the two front engaging-lugs and to the perforation d^7 in the longitudinal grate-bar, while the corresponding rear guide-lugs direct the lever to the space between the rear engaging-lugs, d^{121} and d^{12} .

It will be understood that when the slidable stops are in their inner adjustment they occupy a considerable portion of the slot and diminish its longitudinal extent, so that it is not practicable by the use of the operating-lever to move the grate-sections so far, either to the right or to the left, as to disengage them from their supporting-lugs.

It is obvious that the configuration of the supporting-lugs a^1 and d^6 might be varied from that herein represented without affecting the result accomplished, the essential idea of this part of the invention being preserved under any construction in which the upper surface of the grate-sections, when they are in their operative position, is brought in close proximity to the under surface of the overhanging shelving projections.

I am aware that grates composed of parallel sections, each of which is pivoted by a central end journal in recessed bearings of horizontal cross-plates, have before been made, and I am also aware that a series of secondary grate-bars have been provided with recessed and downturned ends to fit upon the longitudinal connecting-bar of another and alternating series of grate-bars, which are fixed in position. I believe, however, that I am the first to provide a construction in which two parallel grate-sections are both pivoted at the rear, so as to be capable of dumping toward the front only.

I am aware that two oppositely-inclined grate-sections placed side by side, one pivoted at the rear and the other at the front, above a horizontal centrally-pivoted grate, and constituting front and rear basket por-

tions of a fire or fuel chamber, have been shown in an earlier patent; but I believe that I am the first to pivot both of two oppositely-inclined grate-sections at the rear, so that both shall dump toward the front only.

I am aware that fixed grate-bars and movable grate-bars have been arranged in alternation side by side; but I believe that I am the first to construct a grate in which two reciprocating grate-sections have bearings upon an intermediate fixed grate-bar.

Having described my invention, I claim—

1. The combination of two parallel grate-sections, each of which has a rear pivotal bearing, whereby when the sections are dumped each section will discharge its contents toward the front.

2. The combination of the two parallel grate-sections D' and D^2 , each of which has a rear pivotal bearing, whereby when the sections are dumped each section will discharge its contents toward the front.

3. The combination of the two parallel grate-sections D' and D^2 , each having rear bottom engaging-hooks, with rear pivotal bearings, whereby in dumping the contents of each section will be discharged toward the front.

4. The combination of two oppositely-inclined parallel grate-sections, each of which has rear pivotal bearings, whereby when the sections are dumped each section will discharge its contents toward the front.

5. The combination of the two oppositely-inclined parallel grate-sections D' and D^2 , each of which has rear pivotal bearings, whereby when the sections are dumped each section will discharge its contents toward the front.

6. The combination, with a central longitudinal grate bar, of a rear grate-section which is pivotally supported at its rear extremity, and a front grate-section which is pivotally supported at its rear extremity.

7. The combination, with a central longitudinal grate-bar, D , of a rear grate-section, D' , which is pivotally supported at its rear extremity, and a front grate-section, D^2 , which is pivotally supported at its rear extremity.

8. The combination, with a central longitudinal grate-bar, of a rear grate-section which has rear pivotal bearings, and which inclines from its rear extremity downwardly toward the central longitudinal grate-bar, and a front grate-section which has rear pivotal bearings, and which inclines from its front extremity downwardly toward the central longitudinal grate-bar.

9. The combination, with the central longitudinal grate-bar, D , of a rear grate-section, D' , which has rear pivotal bearings, and which inclines from its rear extremity downwardly toward the central longitudinal grate bar, and a front grate-section, D^2 , which has rear pivotal bearings, and which inclines from its front extremity downwardly toward the central longitudinal grate-bar.

10. The combination of a rear grate-section,

which is at its rear extremity pivotally supported upon bearings which project from the walls of the fire-chamber, a central longitudinal grate-bar, which is supported in bearings in or upon the end plates of the fire-chamber, and which is provided at each end with a front hooked supporting-lug, and a front grate-section, which is at its rear extremity pivotally supported upon the front hooked supporting-lugs of the central longitudinal grate-bar.

11. The combination, with a central longitudinal grate-bar, of a rear grate-section, which consists of a longitudinal connecting-web and two distinct alternating series of transverse bars, and a front grate-section, which consists of a longitudinal connecting-web and two distinct alternating series of transverse bars, substantially as and for the purposes set forth.

12. The combination, with a central longitudinal grate-bar, D , of a rear grate-section, D' , which consists of a longitudinal connecting-web, d^7 , and two distinct alternating series, d^{10} and d^{11} , of transverse bars, and a front grate-section, D^2 , which consists of a longitudinal connecting-web, d^{14} , and two distinct alternating series, d^{17} and d^{18} , of transverse bars.

13. The combination, with a central longitudinal grate-bar, which is provided with short lateral bars or agitating-fingers, of a rear grate-section, which embraces a longitudinal connecting bar or web and two distinct series of alternating transverse bars, and a front grate-section, which embraces a longitudinal connecting bar or web and two distinct series of alternating transverse bars.

14. The combination, with a central longitudinal grate-bar, D , which is provided with short lateral bars or agitating-fingers, d^8 and d^9 , of a rear grate-section, D' , which embraces a longitudinal connecting bar or web, d^7 , and two distinct series, d^{10} and d^{11} , of alternating transverse bars, and a front grate-section, D^2 , which embraces a longitudinal connecting bar or web, d^{14} , and two distinct series, d^{17} and d^{18} , of alternating transverse bars.

15. The combination, with a central longitudinal grate-bar, which is provided with lateral supporting-lugs and with short lateral bars or agitating-fingers, of a rear grate-section, which has a series of transverse bars which are adapted to engage with the lateral supporting-lugs upon the central bar, and which has also a series of transverse bars which are adapted to operate in connection with the short lateral bars or agitating-fingers.

16. The combination, with a central longitudinal grate-bar, D , which is provided with lateral supporting-lugs d^8 and d^9 , and with short lateral bars or fingers d^8 and d^9 , of a rear grate section, D' , which has a series of transverse bars, d^{10} , which engage with the lateral supporting-lugs d^8 upon the central bar, and which has also a series of transverse bars, d^{11} , which operate in connection with the short lateral bars or fingers d^8 .

17. The combination, with a central longitudinal grate-bar, which is provided with two series of lateral supporting-lugs and with two series of lateral bars or agitating-fingers, of two grate-sections, each of which has two series of transverse bars of dissimilar longitudinal extent, the longer series being adapted either to rest upon the supporting-lugs or to be passed vertically between them, and the shorter series being arranged coincident with and adapted to be operated in connection with the short lateral bars or agitating-fingers.

18. The combination, with a central longitudinal grate-bar, D, which is provided with two series, d^2 and d^4 , of lateral supporting-lugs, and with two series, d^3 and d^5 , of lateral bars or fingers, of two grate-sections, D' and D², each of which has two series of transverse bars of dissimilar longitudinal extent.

19. The combination, with a central longitudinal grate-bar, D, which is provided with two series, d^2 and d^4 , of lateral supporting-lugs, and with two series, d^3 and d^5 , of lateral bars or fingers, of two grate-sections, D' and D², which have two series, d^{10} and d^{11} , and d^{12} and d^{13} , respectively, of transverse bars, the longer bars, d^{10} and d^{11} , being operated either to rest upon the supporting-lugs or to be passed vertically between them, and the shorter bars, d^{12} and d^{13} , being arranged coincident with and operating in connection with the lateral bars or fingers.

20. The combination of a central longitudinal grate-bar, which has two horizontal transverse perforations, with a rear grate-section, which has two pairs of engaging-lugs which are coincident with the two perforations in the central grate-bar, and a front grate-section, which has a single pair of engaging-lugs, whereby when an operating-lever is applied in one of the transverse perforations the two grate-sections may be agitated simultaneously, or the front section alone may be agitated, and whereby when the lever is applied in the other transverse perforation the rear section only of the grate may be agitated.

21. The combination of a central longitudinal grate-bar, which is supported at its ends upon suitable bearings, and which has two horizontal transverse perforations, with a rear grate-section, which has two pairs of engaging-lugs which are coincident with the two perforations in the central grate-bar, and a front grate-section, which has a single pair of engaging-lugs, the two grate-sections resting upon suitable supports, whereby when an operating-lever is applied in one of the transverse perforations the two grate-sections may be agitated simultaneously, or the front section alone may be agitated, and whereby when the lever is applied in the other transverse perforation the rear section only of the grate may be agitated.

22. The combination of a central longitudinal grate-bar, D, which is provided with perforations d' and d , with a rear grate-section, D', which has engaging-lugs d^{12} d^{121} , which are

coincident with the perforations in the central grate-bar, and a front grate-section, D², which has a single pair of engaging-lugs, d^{15} , whereby when an operating-lever is applied in connection with the perforation d' and the lugs d^{12} the two grate-sections may be agitated simultaneously, whereby when the lever engages the perforation d' and the lugs d^{15} only, the front section alone of the grate will be moved, and whereby when the lever is inserted in the perforation d , in connection with the lugs d^{121} , the rear grate-section, D', may be reciprocated, while the front grate-section will remain at rest.

23. The combination, with a central longitudinal grate-bar, of two grate-sections, each of which has a connecting-web and transverse bars, upon the middle portion of the flat upper surface of each of which is a longitudinal transversely Λ -shaped or pyramidal agitating projection.

24. The combination, with a central longitudinal grate-bar, D, of the reciprocating grate-sections D' and D², each of which includes a longitudinal connecting-web, and transverse bars, upon the middle portion of the flat upper surface of each of which is a continuous unobstructed transversely Λ -shaped or pyramidal longitudinal projection, d^{23} .

25. In a grate, a grate-bar which is provided in the middle portion of its flat upper surface with a longitudinal agitating projection, d^{23} , which in transverse section is of pyramidal or Λ shape.

26. In a grate, a grate bar the main portion of which is flat upon its upper surface, and which diminishes downwardly to the bottom of the bar, and which in the middle portion of such flat upper surface is provided with a transversely pyramidal or Λ -shaped portion, which extends unobstructedly from end to end of the bar.

27. In a grate, the combination, with a connecting-web, of a grate-bar the main portion of which is flat upon its upper surface, and which diminishes downwardly from such surface to the bottom of the bar, and which in the middle portion of the flat upper surface is provided with a pyramidal, double-inclined, or Λ -shaped portion, which extends in uniform dimensions from end to end of the bar.

28. The combination, with a central longitudinal grate-bar, of a grate-section which is provided with a connecting-web, and with a series of bars which are arranged crosswise upon such web and at right angles to the central bar, and each of which in its main portion diminishes in transverse extent from top to bottom.

29. The combination, with a central longitudinal grate-bar, D, of a grate-section which embraces a connecting-web, and a series of grate-bars which extend across the connecting-web, and each of which in its main portion diminishes in transverse extent from top to bottom.

30. The combination, with a central longitudinal grate-bar, D, of a grate-section which

- embraces a connecting-web and a series of bars, each of which in its main portion diminishes in transverse extent from top to bottom, and each of which, upon its flat fuel-supporting surface, is provided with a transversely pyramidal or Λ -shaped portion, which extends centrally along the bar from end to end thereof.
31. The combination, with a central longitudinal grate-bar, of a grate-section which is provided with a series of transverse bars, each of which is in its main portion tapered from top to bottom, and each of which is at its ends of rectangular form.
32. The combination, with a central longitudinal grate-bar, D , of a grate-section, D' , which is provided with a series of transverse bars, d'' , each of which is in its main portion tapered from top to bottom, and each of which has end portions, d''^2 , of rectangular form, as and for the purpose described.
33. The combination of a central longitudinal grate-bar, a grate-section which is provided with a series of transverse bars, each of which is in its main portion tapered from top to bottom, and each of which is at its ends of rectangular form in transverse section, and series of supporting-lugs corresponding with the transverse bars, and each diminishing in transverse extent from the top downwardly.
34. The combination of a reciprocating grate with a vertical end plate, which is provided with a shelving projection which is coincident with the surface of the grate when the grate is in its operative position.
35. The combination of a reciprocating grate with a fuel-chamber, the end plate of which is provided with a shelving projection which is coincident with the surface of the grate when the grate is in its reciprocating position.
36. The combination of a reciprocating grate with a fuel-chamber, the end plate of which is provided with a shelving clearing projection, the upper surface of which inclines from the top downwardly and inwardly toward the center of the fuel-chamber, and the lower surface of which is perpendicular to the vertical face of the end plate and projects over the ends of the grate at a point but a short distance above the same.
37. The combination, with a central longitudinal grate-bar, of two oppositely-placed grate-sections and an end plate which is provided with a shelving projection which closely overhangs each of the two grate-sections.
38. The combination, with a central longitudinal grate-bar, D , and two reciprocating grate-sections, D' and D'' , each resting upon the central longitudinal bar, of an end plate, A' , of the fuel-chamber, which is provided with a shelving projection, a^3 , which closely overhangs the central supporting-bar and each of the two grate-sections.
39. The combination, with an end plate which is provided with an overhanging projection, of a grate-front which is provided with an overhanging projection which is coincident with the projection upon the end plate, and a reciprocating grate-section which is closely overhung by each of the two projections.
40. The combination, with an end plate, A' , which is provided with an overhanging projection, a^3 , of a grate-front or basket portion, E , which is provided with an overhanging projection, e^b , which is coincident with the projection a^3 upon the end plate, and a reciprocating grate-section, D'' , which is closely overhung by each of the two projections.
41. A grate the front or basket portion, E , of which is provided with an overhanging projection, e^b , which operates in connection with the reciprocating portion of the grate to clear the surface of the same.
42. The combination, with a reciprocating grate, of a vertical end plate which is provided upon its interior face with a projection the upper surface of which is inclined from the top downwardly, and the lower surface of which is perpendicular to the vertical face of the end plate.
43. The combination, with a fuel-chamber having a vertical grate-front, of a front supporting-rail which inclines from the top downwardly toward the rear, and which is provided with discharge-openings and with pivoted weighted valves, which operate to automatically discharge into the space below such portions of the contents of the fuel-chamber as may be precipitated upon such supporting-rail.
44. The combination, in a grate, of a rear reciprocating grate-section, a front reciprocating grate-section, and an intermediate fixed grate-bar, the grate-sections resting, respectively, at front and rear upon the grate-bar.
45. The combination, in a grate, of a rear reciprocating grate-section, D' , a front reciprocating grate-section, D'' , and an intermediate fixed grate-bar, D .
46. The combination, in a grate, of a rear reciprocating grate-section, a front reciprocating grate-section, and an intermediate fixed grate-bar, which supports the front of the rear grate-section, and which supports, also, the rear of the front grate-section.
47. The combination, with a grate which embraces a longitudinal connecting bar or web and a series of transverse grate-bars, the ends of which have vertical sides, of a fuel-chamber which embraces a series of supporting-lugs, which correspond with the transverse grate-bars, and which at their ends are diminished from the top to the bottom.
48. A grate-bar which is provided with a lateral supporting-lug, the main upper surface of which is horizontal, and which has at its outer extremity an upturned projection or engaging-hook.
49. In a fire-grate, a grate-bar, D , which is provided with a lateral supporting-lug, d^a , the

main upper surface of which is horizontal, and which has at its outer extremity an upturned projection or engaging-hook, d^{11} .

50. In a fire-grate, a grate-bar which is provided with a lateral supporting-lug which has a flat horizontal upper surface and an upturned hook, in combination with a grate-section which has a bottom hook which engages with and turns pivotally upon the supporting-lug of the grate-bar.

51. The combination, with the grate-bar D, provided with the supporting-lugs d^6 d^6 , of the grate-section D², provided with end bottom hooks, d^{19} d^{19} , whereby it is adapted to engage and turn pivotally upon the supporting-lugs d^6 , as described.

52. A grate which is provided with a pair of downwardly-extending bottom engaging-lugs, and with a corresponding pair of flaring guide-lugs contiguous to the engaging-lugs, whereby when an operating-lever is applied it is directed with certainty to its engaging position.

53. The combination, with the grate-bar D, having a transverse opening extending through the same from front to rear, of a rear grate-section, D', which is provided upon its under surface with engaging-lugs and with flaring guide-lugs, substantially as and for the purposes set forth.

54. The combination of a rear grate-section, a central grate-bar, a front grate-section, a supporting-rail which is provided with a slot, and an operating-lever which engages with both the grate-sections, the central grate-bar, and the slotted supporting-rail.

55. The combination, in a grate, of a central grate-bar provided with a transverse perforation, a front grate-section, a rear grate-section, a fuel-chamber which is provided with supporting-lugs for the front grate-section and for the rear grate-section, a supporting-rail which has a longitudinal slot and a coincident adjustable stop, and an operating-lever which engages with the walls of the slot in the supporting-rail, with each of the two grate-sections, and with the central perforated grate-bar, substantially as described.

56. The combination, with a fuel-chamber which is provided with front and rear supporting-lugs, of a central grate-bar which has transverse perforations, a front reciprocating and dumping grate-section, a rear reciprocating and dumping grate-section, a supporting-rail which has longitudinal slots and coincident adjustable stops, and an operating-lever which engages the central perforated grate-bar, the front grate-section, the rear grate-section, and the slotted supporting-rail, whereby when the operating-lever is applied in one of the slots in the supporting-rail the two grate-sections may be dumped simultaneously, or the front grate-section may be dumped by itself, and whereby when the operating-lever is applied in the other slot of the supporting-rail the rear grate-section only may be dumped.

57. The combination, with a reciprocating

and dumping grate, and a supporting-rail which is provided with operating-slots, and with slidable stops which are adjustable either within or out of the slots, of a central bar which is fixed in position, and which is provided with operating-openings, and an operating-lever which engages with the grate, with the supporting-rail, and with the central bar, substantially as and for the purposes set forth.

58. In a grate, a grate-bar which is provided with a transverse perforation to receive an operating-lever, and with lateral agitating-fingers and lateral supporting-lugs, substantially as and for the purposes set forth.

59. In a grate, a grate-bar, D, which is provided with a transverse perforation, d' , to receive an operating-lever, and with lateral agitating-fingers d^3 and d^5 and lateral supporting-lugs d^2 and d^4 , as set forth.

60. The combination of a reciprocating and dumping grate which is pivotally supported at its rear, a vertical grate-front, and a front supporting-rail which is provided with a longitudinal slot, the walls of which serve as a bearing for an operating-lever.

61. The combination of a reciprocating and dumping grate, a vertical grate-front, E, and a front supporting-rail, A³, which is provided with a longitudinal slot, a^4 or a^{21} , the walls of which serve as a bearing for an operating-lever.

62. In a grate, a series of transverse bars, each of which is in its main portion tapered from top to bottom, and is at its ends of rectangular form.

63. In a grate, a series of transverse bars, d^{10} or d^{17} , each of which is throughout its main portion tapered from top to bottom, and each of which is at its ends of rectangular form.

64. The combination, with the grate-front E, of the supporting-rail A³, having arms A⁴, secured, as described, to the lower portion of the grate-front, and forming in connection therewith the openings a' for the passage of ashes and clinkers.

65. The combination, with the grate-front E, of the supporting-rail A³, secured by its ends to the face-plates A A, and having arms A⁴, which are secured to the lower portion of the grate-front, and which form in connection therewith the openings a' for the passage of ashes and clinkers.

66. The combination, with the grate-front E, of the supporting-rail A³, having openings for an operating-lever, and supported at its ends by the face-plates A, and intermediately by the connection of its arms A⁴ with the lower portion of the grate-front, as set forth.

67. The combination, with the supporting-rail A³, of the grate-front E, the arms A⁴, having bearings a^{23} , and the valves a^{21} , having eccentrically-placed journals a^{22} , as and for the purposes set forth.

68. The combination of vertical end plates, A' A', horizontally-projecting supporting-lugs a' upon the end plates, upwardly-projecting

hooks a^1 upon the supporting-lug, and a grate-section which is provided on its lower rear portion with a downwardly-projecting lug, which terminates in a horizontally-projecting hook, which engages behind the upwardly-projecting hook of the supporting-lug, as and for the purposes specified.

69. The combination of vertical end plates, $A' A'$, horizontally-projecting supporting-lugs a^1 upon the end plates, upwardly-projecting hooks a^1 upon the supporting-lug, and a grate-section, D' , which is provided upon its lower rear portion with a downwardly-projecting lug, d^9 , which terminates in a hook which engages behind the upwardly-projecting hook a^1 of the supporting-lug a^1 , as described.

70. The combination of a vertical end plate which has a shelving projection, a supporting-lug below the shelving projection, and a reciprocating grate which is provided with a rear bottom hook which engages with the supporting-lug, the upper surface of the grate, when it is in its operative position, being nearly in contact with the lower surface of the shelving projection.

71. The combination of vertical end plates, $A' A'$, having shelving projections $a^3 a^3$, a supporting-lug, a^1 , below the shelving projections,

and a grate which is provided with rear bottom hooks, $d^9 d^9$, which engage with the supporting-lugs, the upper surface of the grate, when it is in its operative position, being nearly in contact with the lower surface of the shelving projection.

72. The combination, with the vertical grate-front E , of the supporting-rail A^2 , secured to the face-plates $A A$ and to the grate-front, and provided with openings for an operating-lever.

73. The combination, with the grate-front of an open fire-grate, of a supporting-rail secured to the grate-front and to the face-plates at the sides of the grate-front, inclined downwardly from front to rear, and provided with self-closing valves.

74. In a fire-grate, a grate-section which at each end, at its rear extremity, is provided upon its bottom surface with a downwardly-projecting engaging-hook.

75. In a fire-grate, a grate-section, D' or D^2 , which at each end, at its rear extremity, is provided upon its bottom surface with a downwardly-projecting engaging-hook, d^9 or d^9 .
EPHRAIM J. STORY.

Witnesses:

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