D. F. NISBET.

STOKING GRATE FOR FURNACES.

APPLICATION FILED SEPT. 6, 1910

1,088,445.

Patented Feb. 24, 1914.

4 SHEETS—SHEET 1.

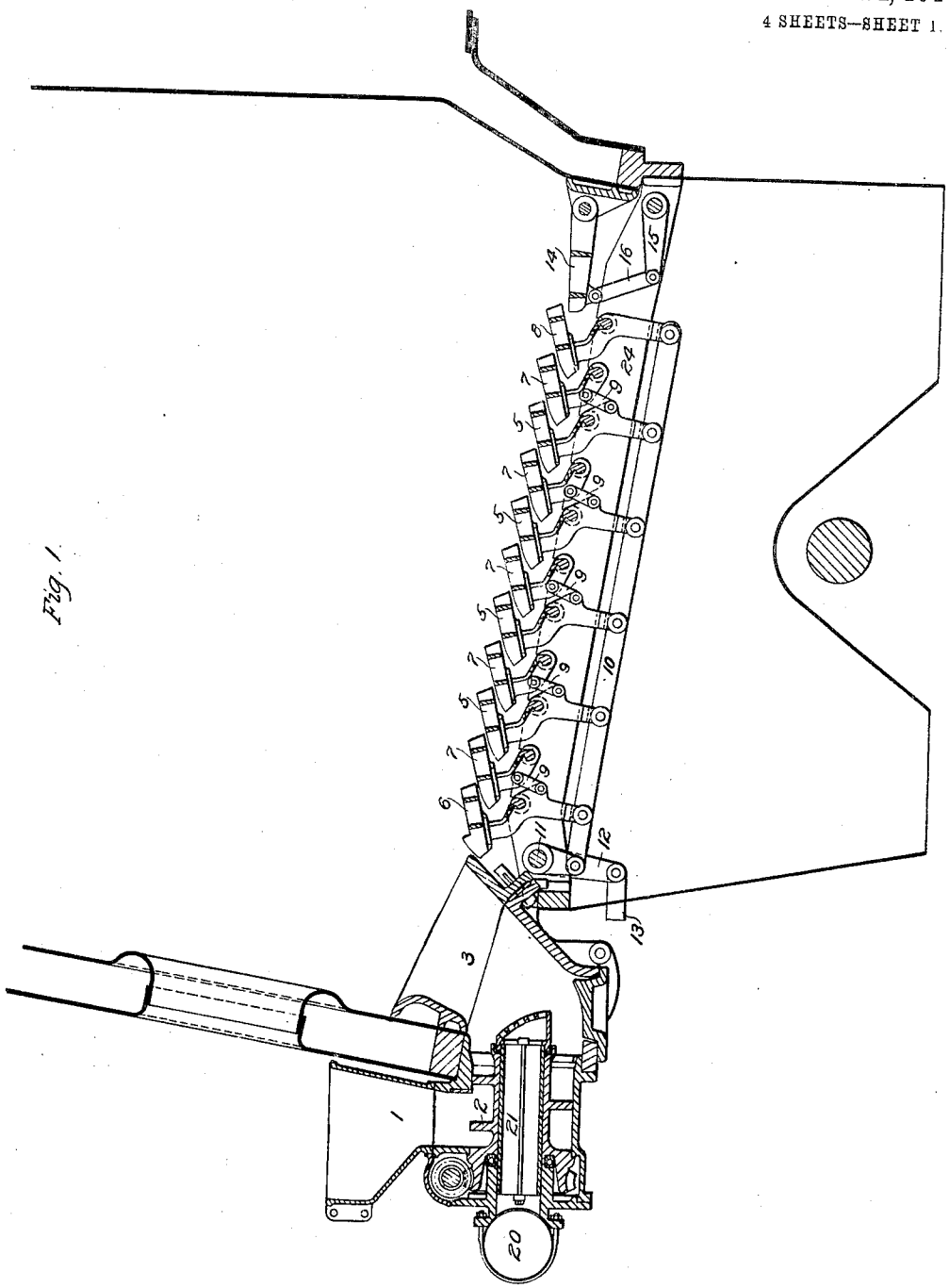


Fig. 1.

WITNESSES

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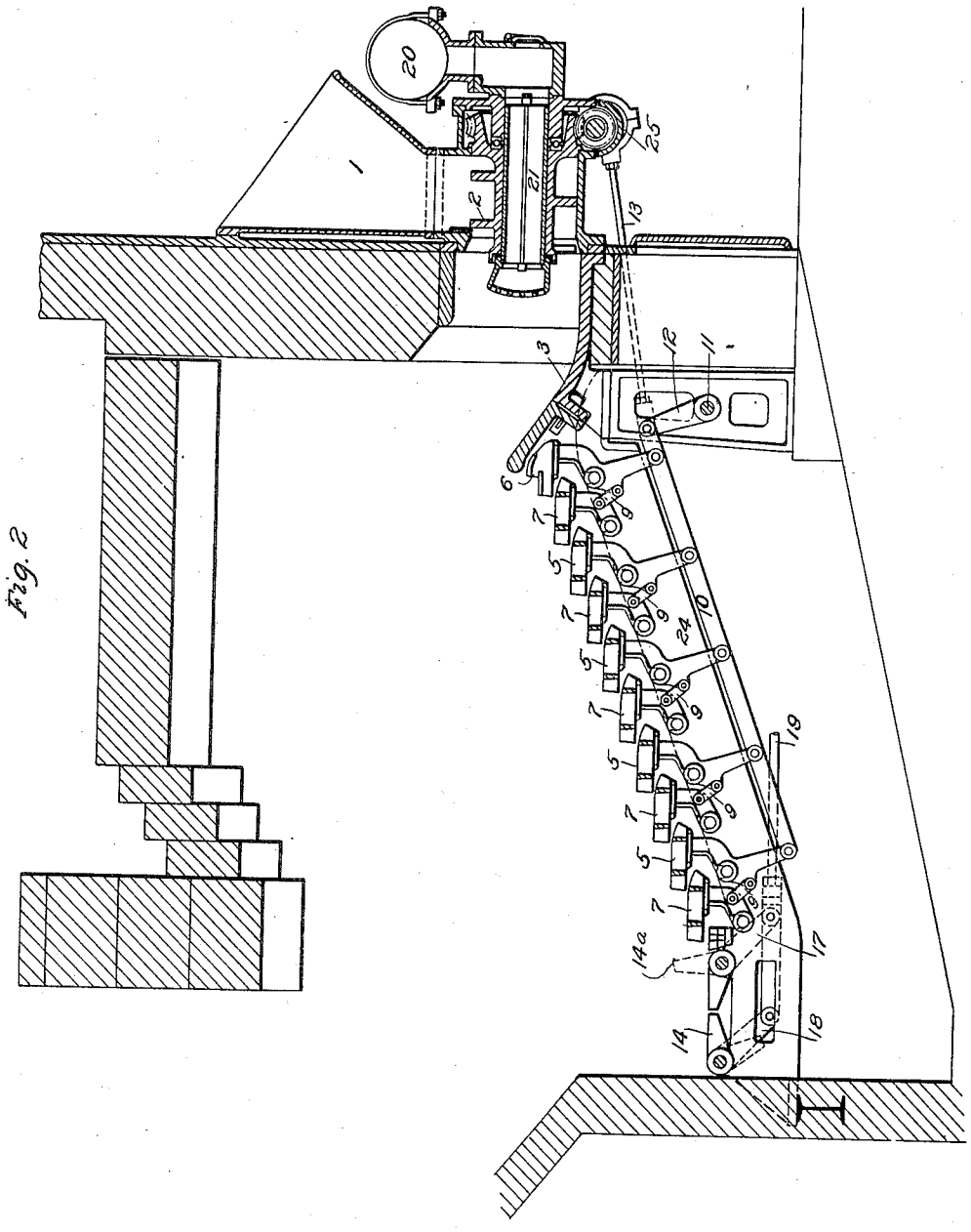


Fig. 2

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4 SHEETS—SHEET 3.

Fig. 3.

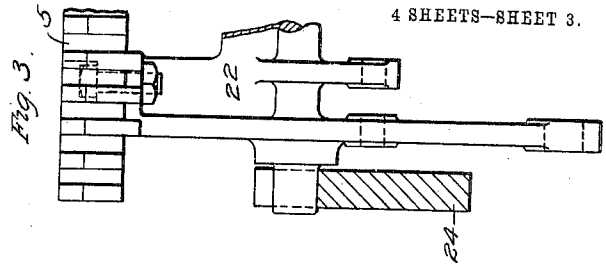


Fig. 5

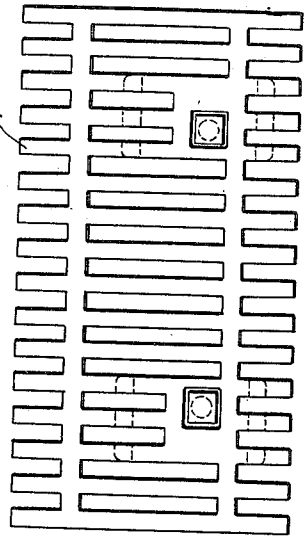


Fig. 4.

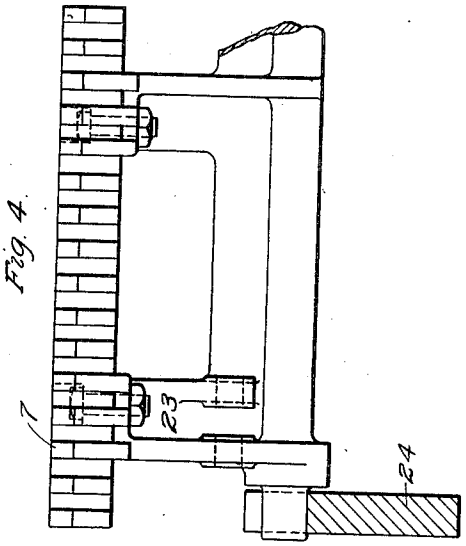
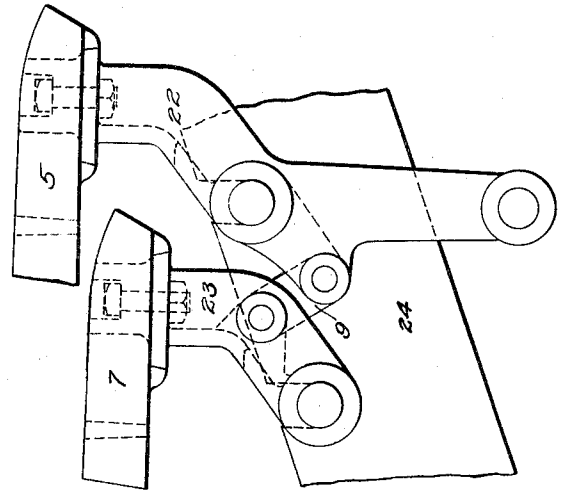


Fig. 6



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4 SHEETS—SHEET 4.

Fig. 7

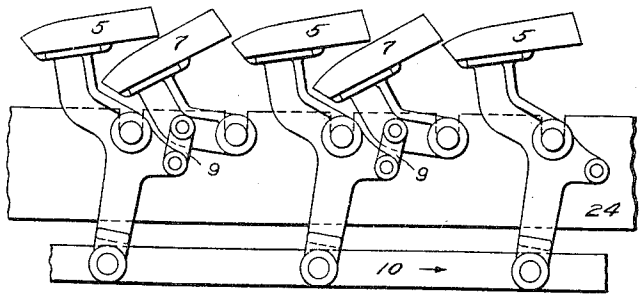


Fig. 8

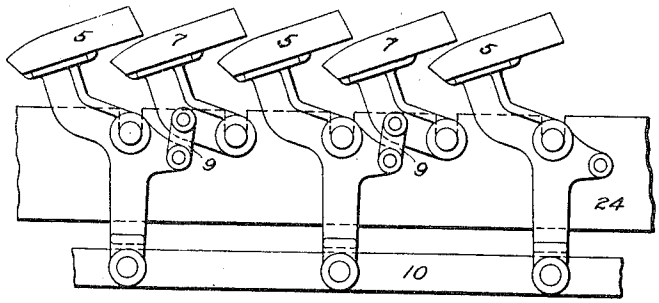
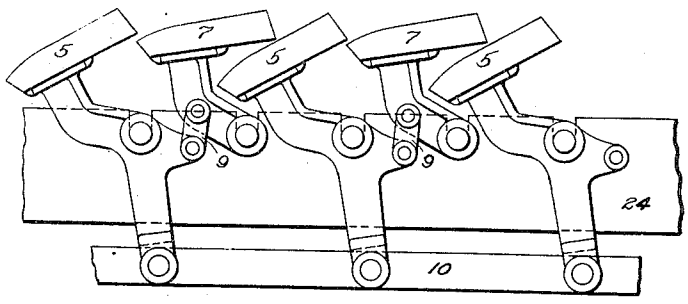


Fig 9.



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UNITED STATES PATENT OFFICE.

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STOKING-GRATE FOR FURNACES.

1,088,445. Specification of Letters Patent. Patented Feb. 24, 1914.

Application filed September 6, 1910. Serial No. 580,610.

To all whom it may concern:

Be it known that I, DAVID F. NISBET, a citizen of the United States, residing at Crafton, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Stoking-Grates for Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in the type of grates known as stoking grates, which operate to effect the continuous advancement of fuel resting on the grate, along the surface, in a direction from the point of the grate at which the fuel is introduced to the farther end thereof; at the same time keeping the fire clean and freeing it from ash.

In the drawings appended, I have illustrated my invention as applied to both locomotive and stationary boilers and in conjunction with my fuel feeder, patented January 19, 1909, No. 910,305, but it is to be understood, however, that the said drawings only show some of the methods of application, and I do not limit myself to the constructions illustrated.

The object of my invention is to provide a simple and efficient apparatus for moving fuel along and over the surface of a furnace grate as positively as would be effected by the so-called chain-grate, but eliminating the disadvantages inherent in that type.

My invention consists broadly in making the form of the grates, the contour of the arms supporting the grates, and the location of the pivots with reference to the surface of the grates, such that when the grates are oscillated within a limited range, the alternate grates are simultaneously moved in the same direction and the intermediate grates in the opposite direction, the bottom working face of one grate preserves practically a constant relation to the top working surface of the grate next to it in the direction in which the fuel is being progressed; the continued oscillation of the grates causing a continuous progressive movement of the fuel from one grate to the next until it reaches the dump grate largely in the form of ash. The continuous oscillation of the grates also tends to prevent the formation of large clinkers or the accumulation of ash under the fire.

Referring to the drawings, Figure 1 is a longitudinal section through the grate as applied to a locomotive boiler. Fig. 2 is a longitudinal section through an installation of the grate, slightly modified to show its adaptability to a stationary boiler furnace. Fig. 3 shows the construction of the driving end of the driving grate frames. Fig. 4 shows the construction of the driven grate frames. Fig. 5 is a plan of one section of a grate. Fig. 6 shows a driving and a driven grate in their relative positions. Fig. 7 shows a group of grates mounted in their supporting bars, in one extreme position of movement. Fig. 8 shows the same group in mid-position, and Fig. 9 shows the group in the extreme position of movement opposite to that shown by Fig. 7.

Describing the operation of my invention: Fuel is introduced through the hopper 1, Figs. 1 and 2, to the feeding mechanism 2, Figs. 1 and 2, thence to the retort or dead-grate 3, Figs. 1 and 2. In the installation shown in Fig. 1, this retort is provided with doors 26, held in closed position by bolts, latches or any other suitable means. In this retort 3, Figs. 1 and 2, the hydrocarbon elements contained in the fuel are distilled and mixed with the proper amount of oxygen by means of air introduced through the blast pipe 20 and twyer pipe 21, Figs. 1 and 2, and are burned. The continued operation of the feeding mechanism pushes the coked residue over the edge of the retort on to the series of grates 5, 6, and 7, which are mounted in bearing bars 24. It will be noted that the grate 6, immediately in front of the retort, has a raised portion which serves as a coke breaker and also permits making the movement of this portion of the grate conform to the contour of the lip of the retort or dead-grate.

The grates 5 and 6 are connected by lever arms at the lower extremities of their supporting frames 22 to the bar 10; frames 23 for grates 7 are connected by the links 9 to projecting lugs on the frames for the grates 5 and 6 in such a manner as will cause the grates 6, 5, 5, 5, to move in the same direction and the intermediate grates 7, 7, 7, to move simultaneously in the opposite direction. The bar 10 is actuated from the rock shaft 11, through the lever 12 and connecting links 13, by any suitable means, for instance, the eccentric 25, Fig. 2. It is of course understood that these grates 7 can

be operated by a separate mechanism. This would be simply the substitution of an equivalent, but I prefer the construction shown.

When the partially burned fuel is on the grates 5, 6, and 7 and the bar 10 is given a reciprocating motion by any suitable mechanism, the grates will assume in sequence the positions shown in Figs. 7, 8, and 9, and, of course, progressively, all positions intermediate between those shown, both by the forward and return strokes of the reciprocating bar 10. Referring to Fig. 7, it will be noted that the grates 7, 7 are in a receded position, exposing a little less than half their width, while the grates 5, 5, 5 are exposed practically their entire width. Now, when the bar 10 moves in the direction shown by the arrow, the grates 5, 5, 5 begin to recede while the grates 7, 7 advance, passing through all the intermediate stages to the positions shown in Figs. 8 and 9, when the bar 10 is in a position for beginning the return stroke. It is obvious that the fuel lying on the grates 5, 5, 5 in Fig. 7 will be pushed forward by the double action of the grates 5, 5, 5 receding and the grates 7, 7 advancing through all the stages to Fig. 9. When the reverse movement of the driving bar takes place, the relation of the movements of the grates is identical with the relation of the movements during the forward stroke, so that the forward progress of the fuel is practically continuous until it reaches the dump grates 14, Fig. 1, and 14 and 14a, Fig. 2, when, if properly operated, there remains little but ash, which can be removed by operating the dump grate through the levers 15 and link 16, Fig. 1, or the levers 17 and 18 and rod 19, Fig. 2, through the usual connections, which are well understood, though not shown. It is also obvious that the movement of the grates will have a tendency to prevent the formation of clinkers, and will, by the movement of one grate over the other, obviate the accumulation of ash under the fire, at the same time keeping the fire well broken up so as to permit the air necessary for perfect combustion to permeate the whole fuel bed.

It will be noted that in whatever position the grate may be, the air admitted underneath can circulate freely around all parts of the grates, keeping them cool and thereby prolonging their useful life. It will also be noted that in installations of the grate, the angle of the grate can be such as will preclude the possibility of the coal "avalanching" or sliding so as to leave a portion of the grate surface bare, which is a prolific cause of trouble in grates depending on the effect of gravity for advancing the fuel.

I have shown my grate in conjunction with my fuel feeder, but it is obvious that the grate can be used with almost any kind of feeding mechanism or even with hand feeding, and therefore I do not confine myself to the method of feeding shown, as these installations are shown only to illustrate the adaptability of my grate. Also, a grate having alternately a moving grate of the type herein mentioned and a stationary grate can be used, but the construction shown is to be preferred.

The many advantages of my invention will be appreciated by those skilled in the art, as the apparatus is simple and durable, and will perform all the functions which are usually obtained by apparatus of a much more intricate and expensive character.

Having described my invention, I claim:

1. A stoking grate mechanism consisting of a series of spaced, overlapping, oscillating grates pivoted in suitable carrier frames or bars, each grate being supported independently of the other grates of the series and adapted to rotate through a limited angle in a direction opposite to that of the adjacent grates of the series, thereby varying the lap of adjacent grates while preserving a substantially constant vertical distance between the overlapping surface thereof.

2. A stoking grate mechanism comprising a series of spaced, overlapping, oscillating grates, alternate grates being adapted to move simultaneously in one direction, the intermediate grates moving simultaneously in a contrary direction, thus varying the amount of lap while maintaining a practically constant vertical distance between the overlapping surfaces of adjacent grates; means for moving alternate grates of the series simultaneously in one direction, means for moving the intermediate grates of the series simultaneously in the contrary direction, and carrier bars or frames in which said grates are pivotally mounted, each grate being supported independently of the other grates of the series.

3. A stoking grate mechanism comprising a series of spaced, overlapping, oscillating grates pivoted in suitable carrier frames or bars, each grate being supported independently of the other grates of the series, alternate grates being adapted to move simultaneously in one direction, the intermediate grates moving in a contrary direction so as to vary the amount of lap while preserving a substantially constant vertical distance between the adjacent surfaces of the overlapping portions of successive grates, the first grate of the series being provided with a raised portion adapted for coke breaking and the back being of such contour as will seal the space underneath the edge of the dead grate or retort in conjunction with which the grate mechanism is used, for the purpose of preventing waste of fuel.

4. A stoking grate mechanism consisting of a series of partially overlapping grates,

pivoted in fixed carrier bars, mechanism for oscillating adjacent grates simultaneously in opposite directions through a limited arc, about said pivots, and such relation between the overlapping surfaces of the adjacent grates as will preserve a practically constant vertical distance between the grates throughout their entire range of movement.

5. A stoking grate mechanism having partially overlapping grates with forwardly extending fuel supporting webs, curved rearwardly extending fuel supporting webs, frames supporting the said grates and rigidly attached thereto, pivots on said frames to act as their axes of movement, the location of the pivots on each frame with reference to the contours of the top and bottom surfaces of the grate and of the adjacent grates being such as will, when alternate grates are rotated simultaneously in one direction through a limited arc, about their respective pivots, and the intermediate grates are rotated simultaneously in the opposite direction through a limited arc, about their respective pivots, cause the overlapping surfaces of the adjacent grates of the series to maintain a substantially constant vertical relation to each other.

6. A stoking grate mechanism comprising a series of overlapping, oscillating grates having forwardly and rearwardly extending fuel supporting webs, supporting frames for the grates rigidly attached thereto, pivots on the frames, acting as axes of movement for the grates, said pivots being journaled in stationary carrier bars, alternate frames having downwardly extending driving arms adapted for attachment to a reciprocating bar, means for operating the reciprocating bar, moving alternate grates of the series simultaneously in one direction, and means for moving the intermediate grates of the series simultaneously in a contrary direction, so as to vary the amount of lap of successive grates while preserving a practically constant vertical distance between the adjacent surface thereof.

7. A stoking grate mechanism comprising carrier bars, grate frames pivoted therein, grates rigidly attached to the said frames, each grate partially overlapping the grate next succeeding in the direction of movement of the fuel, the top and bottom of the grates having such contour as will, when adjacent grates are partially rotated in opposite directions, about their respective pivots, preserve substantially a constant vertical relation between the overlapping portions of the said grates.

8. A stoking grate mechanism comprising a series of overlapping oscillating grates pivoted in carrier bars, each grate being supported independently of the other grates of the series, the contour of the top and bottom of the grates having such relation to the location of the pivot points as will maintain a practically constant space between the overlapping portions of the grates when the adjacent grates of the series are moved simultaneously in opposite directions.

9. A stoking grate mechanism comprising carrier bars, a series of frames pivotally mounted in said carrier bars, grates mounted upon, and rigidly attached to, the said frames, the forward portion of each grate partially overlapping the rear portion of the next succeeding grate of the series, successive grates of the series being adapted to rotate in opposite directions through a limited arc, about the pivot points of their respective frames, thereby varying the lap of successive grates while maintaining a practically constant space between the adjacent surfaces thereof and imparting a progressive movement to the fuel.

10. A stoking grate mechanism comprising a series of overlapping oscillating grates, each grate being free to move in a direction contrary to that of the next preceding and next succeeding grates, means for moving alternate grates of the series simultaneously in one direction, means for moving the intermediate grates simultaneously in the opposite direction so as to vary the lap of successive grates while preserving a substantially constant vertical distance between the overlapping surface thereof; stationary carrier bars, and frames, pivotally mounted on the said carrier bars and supporting the said grates, each grate being supported independently of the other grates of the series.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DAVID F. NISBET.

Witnesses:
ERNST FRANCKE,
F. S. NISBET.