L. R. STOWE.

AUTOMATIC STOKER.

APPLICATION FILED APR. 10, 1917.

1,405,072.

Patented Jan. 31, 1922.

3 SHEETS—SHEET 1.

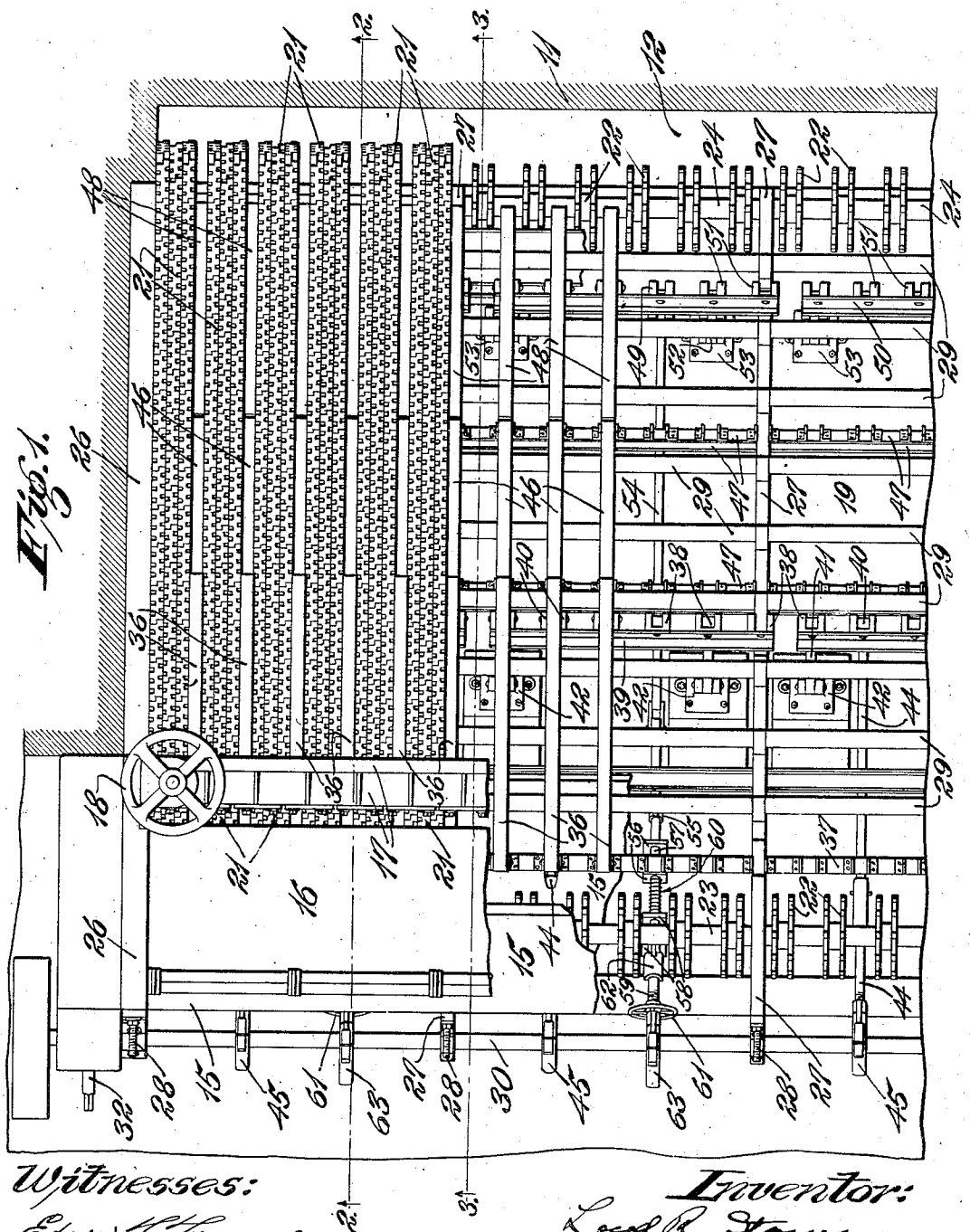

Fig. 1.

Witnesses:

Edgar T. Farmer.

Arthur Colcombe

Inventor:

Loyd R. Stowe,

by Cornell Cornell

his Attys.

L. R. STOWE.

AUTOMATIC STOKER.

APPLICATION FILED APR. 10, 1917.

1,405,072.

Patented Jan. 31, 1922.

3 SHEETS—SHEET 2.

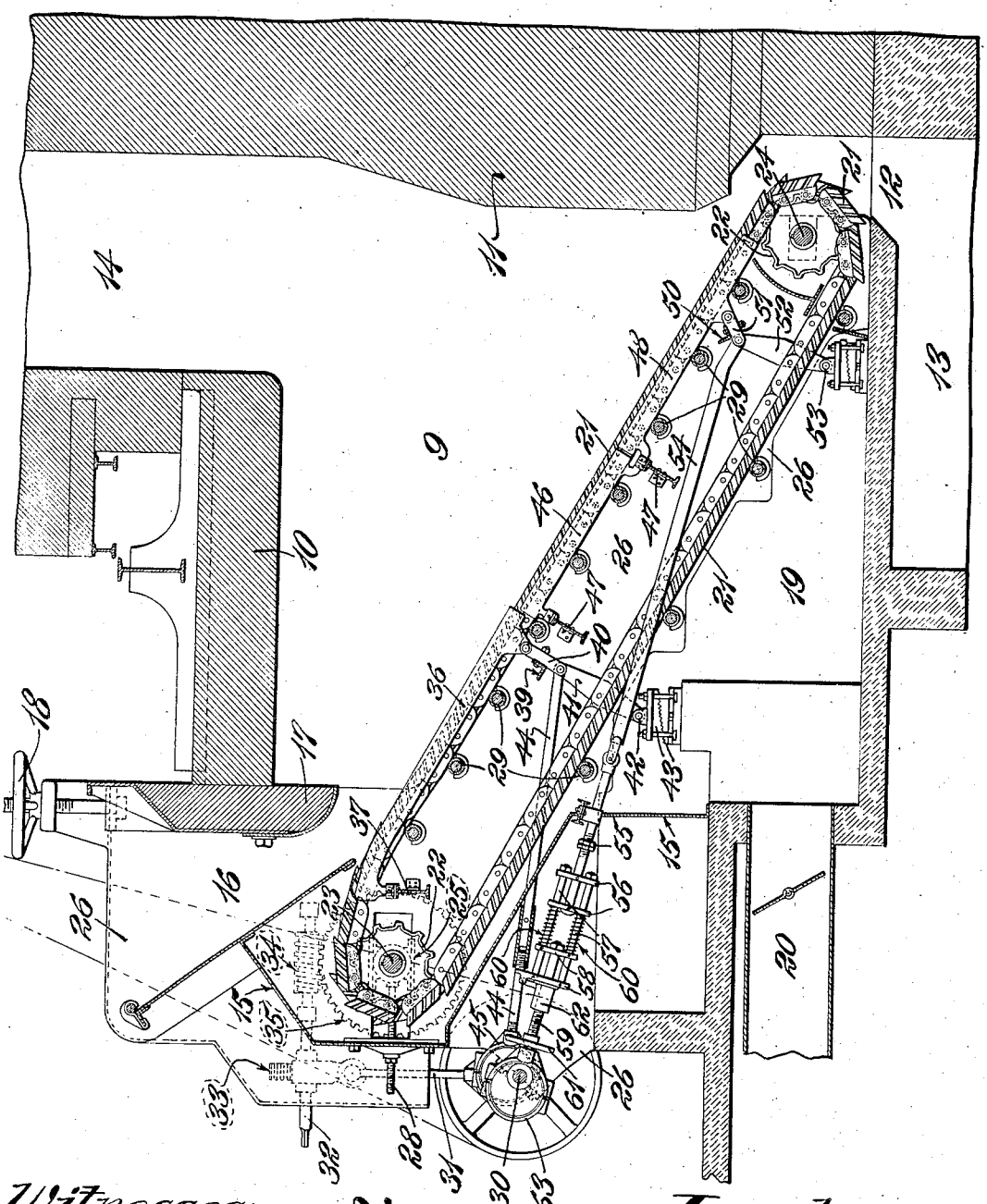

Fig. 2.

Witnesses:

Edgar T. Turner.

A. M. Stolcombe.

Inventor:

Loyd R. Stowe,

by Cameron & Cameron

his Attys.

L. R. STOWE.

AUTOMATIC STOKER.

APPLICATION FILED APR. 10, 1917.

1,405,072.

Patented Jan. 31, 1922.

3 SHEETS—SHEET 3.

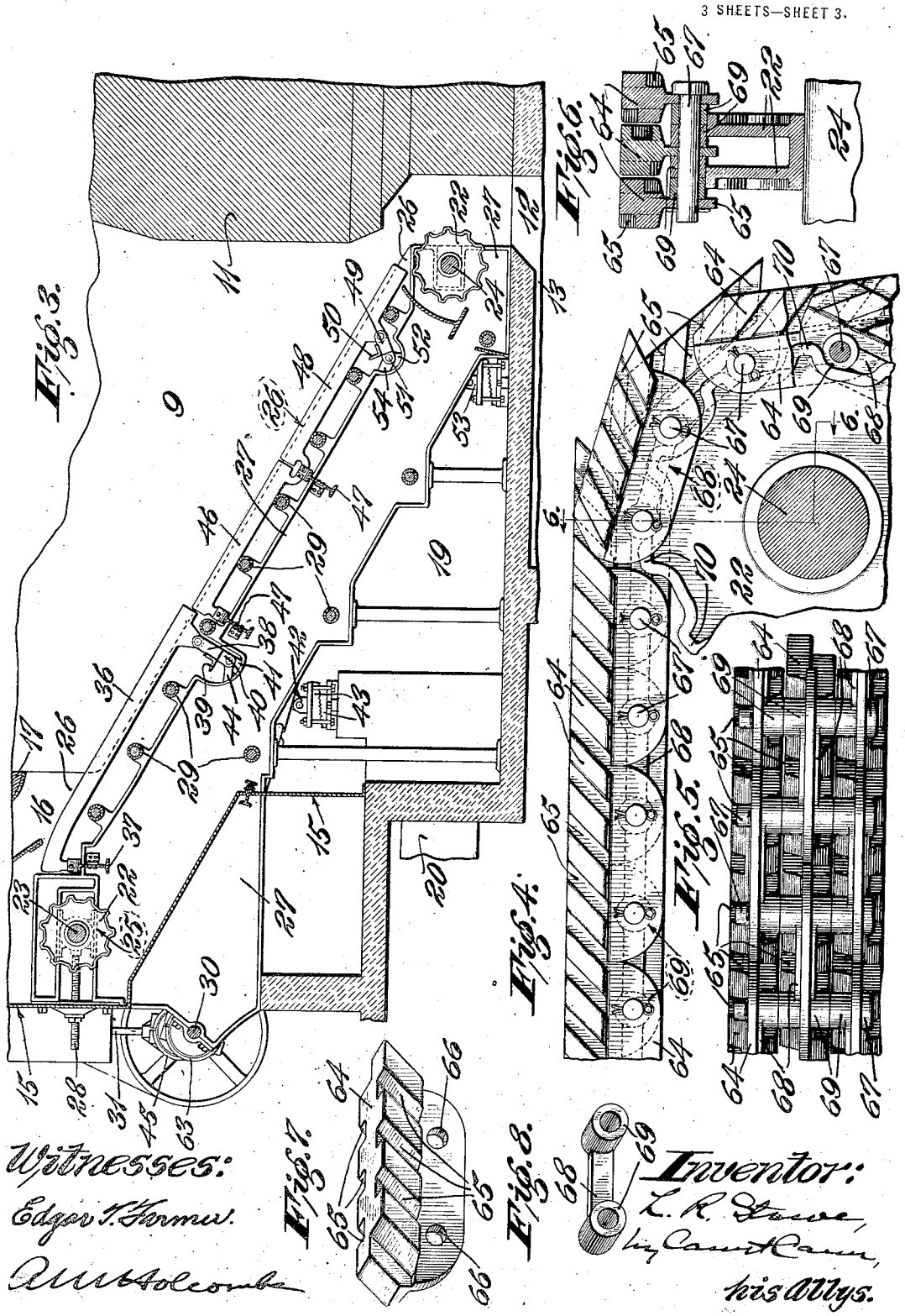

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Witnesses:

Edgar T. Hamm.

R. M. Holcombe

Inventor:

L. R. Stowe,

by Cant Cann,

his Attys.

UNITED STATES PATENT OFFICE.

LOYD R. STOWE, OF MAPLEWOOD, MISSOURI.

AUTOMATIC STOKER.

1,405,072. Specification of Letters Patent. Patented Jan. 31, 1922.

Application filed April 10, 1917. Serial No. 160,912.

To all whom it may concern:

Be it known that I, LOYD R. STOWE, a citizen of the United States, and a resident of the city of Maplewood, in the county of St. Louis and State of Missouri, have invented a new and useful Improvement in Automatic Stokers, of which the following is a specification.

This invention relates to a type of mechanical stoker for feeding coal to a furnace wherein the grate consists in part of a plurality of slowly moving inclined chains which progressively carry a layer of coal through the ignition and combustion zones of the furnace and discharge the ash at its lower end into the ash pit.

The objects of the invention are to control the rate of feeding of the coal throughout the length of the fuel bed; to break up the layer of coal in the ignition zone of the fuel bed; to permit sufficient air to pass through it to secure quick ignition; to retard the movement of the coal as it approaches the lower end of the combustion zone in order that the thickness of the fuel may be so controlled that only the proper amount of air for efficient combustion will pass through it; and to keep upon the grate near its bridge wall end sufficient spent fuel or ash to protect the bars and chains from overheating. Another object is to so dispose the air passages through the grates as to permit the use of forced draft for securing a high rate of combustion. Further objects of the invention are to minimize the sifting of unburned coal and ash through the grate, to provide for the easy replacement of worn or broken parts, and to arrange the parts in sections which can be multiplied at will to produce as wide and as long a grate as may be desired.

The invention consists in dividing the grate into sections composed of series of progressively moving chains alternating with non-progressing movable bars which can be adjusted to exert a greater or less influence on the rate of feed of the fuel over them. The invention also consists in the details of construction of the frames, chain grates, and various parts of the operating mechanism as hereinafter described, reference being had to the accompanying drawings forming a part of the specification.

What is claimed as the invention appears in the appended claims. In the drawings, wherein the same reference characters designate the same or similar parts in the several views,

Fig. 1 is a plan view of a portion of a stoker embodying the invention, parts of the hopper, chains, bars, and casing being removed to disclose parts beneath;

Fig. 2 is a vertical section of the same on the line 2—2 in Fig. 1, looking in the direction of the arrows;

Fig. 3 is a similar sectional view on the line 3—3 in Fig. 1, the chains being removed;

Fig. 4 is a side view of a portion of a chain and sprocket, drawn to a larger scale;

Fig. 5 is a bottom plan view of a portion of a chain;

Fig. 6 is a cross-section through a chain and sprocket on the line 6—6 in Fig. 4;

Fig. 7 is a perspective view of a chain block; and

Fig. 8 is a perspective view of a chain link.

The invention is shown in the drawings applied to a furnace having a combustion chamber 9 covered by a fire-brick arch 10, and having a back fire or bridge wall 11 beneath which is a passage 12 into the ash pit 13. Above the back wall of the furnace is an open flue 14 for the hot furnace gases. The front wall 15 of the furnace is metal, and has a hopper 16 running across its top for the entire width of the furnace. The hopper discharges into the front of the furnace, on top of the grate. A vertically sliding gate 17 may be raised and lowered by means of a screw and hand wheel 18 at each end to adjust the width of the fuel feed opening from the hopper on to the grate. Beneath the grate is an air chamber 19 to which air may be supplied through a duct 20 by either forced, induced or natural draft.

The grate is composed of moving and stationary elements. The moving elements are narrow endless chains 21 which are spaced apart and are supported on sprocket wheels 22 arranged on two parallel shafts 23, 24, placed one at the front end and the other at the back end of the furnace. The front sprocket shaft 23 is carried in journal boxes 25 which are slidably mounted in guides in the side frame 26 and intermediate frames

27, and are adjustable forward and back by means of screws 28 which pass through the front wall 15 of the furnace and are held in adjusted position by nuts on their outer ends. The sprockets on the front shaft 23 are keyed in position on the shaft.

The rear sprocket shaft 24 is preferably held in supports which are fixed in the back ends of the frames, near the bottom of the furnace, adjacent to the passage 12 into the ash pit. The sprocket wheels on the rear shaft 24 are free to turn with the movement of the chain. The front sprocket shaft is located near the top of the furnace, below and in front of the fuel hopper so that the chains slope down from front to back. The chains are supported intermediate the front and back ends of the grate upon rollers 29 which are journaled in bearings in the frames.

The sprocket shaft 23 is rotated slowly from the power driven shaft 30 by means of a suitable reduction gearing. The gearing shown in the drawings comprises an eccentric end rod 31 which is mounted on the shaft 30, and which rotates a worm shaft 32, journaled at the end of the furnace front, by means of a ratchet and wheel device 33. The worm shaft carries a worm 34 which engages with a worm wheel 35 fixed upon one end of the sprocket shaft 23. The ratchet and wheel device 33 may be set to turn the worm shaft 32 at any desired speed for regulating the rate of travel of the chains to suit the conditions of service.

In the spaces between the chains 21 are the stationary grate elements, which are shown in the drawings arranged in three series of similarly shaped and operated bars. Near the front end of the grate is a series of shaking bars 36, which are pivotally supported at the front or upper ends upon cross-beams 37 which connect the frame. The rear ends of the bars 36 are pivoted between forks 38 which are mounted side by side upon angle bars 39 which extend crosswise of the furnace beneath the bars and chains and over the intermediate frames.

The angle bars 39 are supported near their ends by links 40 which are pivoted to the upper ends of oscillating toggle links 41, the lower ends of which are pivoted to vertically adjustable bearings 42 resting upon adjusting wedges 43 which are supported by masonry piers in the air space 19 beneath the grate. A connecting rod 44 is pivoted to the lower end of an intermediate link 40 for operating the toggle links 41 to raise and lower the angle bars 39 and thereby move the back ends of the grate bars 36 up and down. The other end of the connecting rod 44 passes between the lower stretches of the two adjacent chains, and extends through a small opening in the front wall 15. The outer end of each connecting rod is adjustably secured to an eccentric strap 45 which works on one of a series of eccentrics mounted on the shaft 30, which extends across the front of the furnace and is journaled in the frames in front of the front wall below the hopper. This shaft 30 is rotated at such speed as to oscillate the back ends of the bars 36 slowly up and down. The arrangement of eccentrics, connecting rods and links is such as to move the bars up and down twice for each revolution of the shaft 30.

A second series of bars 46 is arranged across the middle of the grate, their ends being supported on cross beams 47 forming part of the frame work of the grate. The tops of these bars are spaced below the tops of the chains, and are in alinement with the front bars in their lowest position. In the particular arrangement shown in the drawings, the bars 46 are not arranged for movement.

A third series of bars 48 is arranged across the back end of the grate behind the bars 46, with their front ends pivotally supported on the cross beams 47 in alinement with the bars 46. The rear ends of the bars 48 are adjustable up and down for the purpose of retarding more or less the movement of the fuel over them and thereby regulating the depth of fuel near the lower end of the grate. The rear ends of the bars 48 are pivoted between the forks 49 which are mounted on angle bars 50 arranged beneath them and supported on links 51, the lower ends of which are pivoted to the upper ends of toggles 52. The lower ends of the toggle links 52 are pivoted to vertically adjustable bearings 53 which rest upon adjusting wedges on the bottom of the furnace.

Each section of the furnace has a connecting rod 54 which is pivoted to the lower end of an intermediate link 51 for operating the angle bar 50 and grate bars 48. The connecting rods extend between the lower stretches of the spaced chains and through openings for them in the front wall 15. Each connecting rod 54 has an adjustable stop 55 upon its projecting end which prevents the rod from moving rearwardly farther than is necessary to lift the bars 48 to the desired height. The front end of each connecting rod is fitted with cross yokes 56 which slide on two yoke guides 57 forming part of a frame 58, which in turn slides upon an eccentric rod 59. Springs 60 are arranged on the guides between the yokes and frame for holding the frame and yokes apart. This arrangement provides a yielding connection between the connecting rod and the eccentric rod.

The eccentric rod 59 slides through the frame 58, and is threaded for part of its length and provided with an adjustable stop in the form of a hand wheel that may be set

to strike against a sleeve 62 at any desired point in the stroke of the eccentric rod to move the frame 58 and connecting rod; and the movement of the connecting rod will continue until the stop 55 brings up against the front of the furnace, after which further movement of the eccentric rod will merely compress the springs 60 without moving the connecting rod. The sleeve 62 is pivoted to the frame 58, and may be swung up out of the way of the hand wheel in order to prevent operation of the connecting rod and bars 48 by the eccentric rod. The eccentric rods 59 are secured to eccentric straps 63 which work on eccentrics which are spaced along the shaft 30 between the eccentrics which work the first series of grate bars 36. The arrangement of eccentrics, connecting rods and toggle links is such as to cause the grate bars 48 to make one up and down movement for each revolution of the shaft 30; and the height of their movement above the chains and the period during which they remain in raised position can be adjusted to suit service conditions. If service conditions demand, a similar movement can also be provided for the second and first series of bars, 46 and 36; and any number of series of these bars down the length of the furnace may be provided.

As above described, the furnace is divided transversely into sections, each section being composed of alternating progressing and non-progressing bars. Each of these sections is independently operated by its individual eccentric and associated mechanism, so that should the fuel bed for any reason tend to burn out more rapidly in one part of the furnace, this tendency can be offset by properly adjusting the height of the throw of the grate bars 48 and the length of dwell in their raised positions so as to cause more retardation of the fuel in the section affected.

Each grate chain 21 is composed of three rows of blocks 64, the blocks in the outer rows being arranged side by side, and the blocks in the middle row breaking joint with those in the outer rows. The top portions of the blocks are wider than their bottoms and are provided with diagonal grooves 65 on each side face which permit air to pass up through the chains from the air space 19 below the grate. These grooves 65 cross the chain at such an angle as to be nearly horizontal in the top stretch of the chain which constitutes the support for the fuel, and this arrangement prevents the finer particles of fuel from sifting through the grooves into the space beneath the grate.

The bottom portions of the chain blocks have holes 66 through them near the ends for the transverse pins 67 which hold the blocks together. Links 68 are arranged on the pins 67 alongside of and between the respective blocks to strengthen the chain and space the blocks apart. The links do not entirely fill the spaces between the adjacent rows of blocks, and are provided with offset hubs 69 at their ends which meet at the middle of the space and which form sleeves on the pins 67 for the teeth 70 of the sprocket wheels 22 to engage between, as shown in Figures 4, 5 and 6. Rollers may be used between the links instead of the offset hubs, if desired. These links or rollers take the greater part of the wear of the sprockets, and may be easily replaced when worn out by lifting up a single stretch of chain and removing the pins 67.

From the foregoing description it is evident that the invention provides positively acting means for feeding the fuel along the entire length of the grate, and for maintaining the fuel bed of uniform thickness across the width of the furnace. It is also evident that the invention provides positively acting means for retarding the travel of the fuel at any predetermined point or points lengthwise of the grate, so that the desired varying thickness of the fuel at successive points, because of the progressive combustion of the coal, can be controlled in a positive manner.

The thickness of the fuel bed and the rate of feed can be regulated to suit the conditions of service. By retarding the fuel near the lower end of the grate the amount of ash upon the grate is increased, thereby protecting the chain from burning. The grate bars 48 may be renewed with little trouble. Also, the arrangement of shaking grate bars and their control and the construction of the chains is such that forced draft can be used without causing the fire to burn unevenly. The invention is not restricted to the details of the construction shown and described.

I claim the following as my invention:

1. In a chain grate, in combination with progressively moving grate elements for advancing the fuel upon the grate, intermediate non-progressive grate elements for retarding the rate of advance of the fuel upon said progressively moving elements, and means for tilting said non-progressive elements across the path of the fuel.

2. In a chain grate, in combination with progressively moving grate elements for advancing the fuel upon the grate, intermediate non-progressive grate elements for retarding the rate of advance of the fuel upon said progressively moving elements, and adjustable means for tilting the rear ends of said non-progressive elements across the path of the fuel.

3. In a chain grate, in combination with moving grate elements, non-progressive grate elements comprising elements arranged longitudinally between said moving grate elements, and means for elevating certain sections of said non-progressive grate elements

at the back end of said grate, whereby the progress of the fuel on said grate may be retarded.

4. In a chain grate, in combination with moving grate elements, sectional non-progressive grate elements arranged for vertical movement between said moving grate elements, means for elevating the sections of said sectional grate elements at the back end of said grate, and means for controlling said elevating movement whereby the progress of the fuel on said grate may be retarded to maintain a desired depth of fuel on said grate.

5. In a chain grate, in combination with moving grate elements, non-progressive grate elements arranged for vertical movement between said moving grate elements, means for shaking up and down portions of said non-progressive grate elements at the front end of said grate to break up the fuel, means for elevating portions of said non-progressive grate elements at the back end of said grate, and means for controlling said elevating movement whereby the progress of the fuel on said grate may be retarded to maintain a uniform depth of fuel on said grate and adapt it for forced draft.

6. A chain grate comprising alternating sections of traveling chains and stationary bars, means for controlling the speed of said chains, means for elevating portions of said bars to project above said chains, and means for controlling said elevating means to prevent unduly retarding the movement of fuel on said chains.

7. An inclined grate comprising alternating sections of traveling chains and relatively stationary bars sloping down from front to back, means for controlling the feeding of fuel on to said grate, means for inclining portions of said bars to project above said chains, and means for periodically actuating said elevating means to retard the movement of fuel on said chains.

8. An inclined grate comprising alternating sections of traveling chains and stationary bars sloping down from front to back, means for controlling the feeding of fuel on to said grate, means for shaking portions of said bars up and down to break up the fuel near the upper end of said grate, means for elevating portions of said bars to project above said chains near the lower end of said grate, and means for periodically actuating said elevating means to retard the movement of fuel on said chains.

9. A mechanical stoker comprising progressively moving grate elements for moving the fuel through the furnace, relatively stationary grate elements arranged between said moving grate elements, and means for periodically elevating said relatively stationary grate elements to retard the moving fuel, said elevating means comprising bars arranged beneath and crosswise of said grate elements, means for connecting said bars and said relatively stationary grate elements, and operating means for said bars for raising and lowering them periodically, said bar operating means comprising links pivoted thereto at their upper ends and supported upon adjustable bearings at their lower ends, and connecting rods provided with adjustable parts for controlling the length of throw and the duration of throw, whereby the retarding effect of said bars on the moving fuel can be controlled.

10. A mechanical stoker comprising progressively moving grate elements, relatively stationary grate elements arranged between said moving grate elements, and means for periodically elevating said relatively stationary grate elements, said elevating means comprising bars arranged beneath and crosswise of said grate elements, means for connecting said bars and said relatively stationary grate elements, and operating means for said bars for raising and lowering them at intervals, said operating means comprising connections provided with adjustable parts for permitting said bars to dwell in their raised position.

11. A mechanical stoker comprising progressively moving grate elements, relatively stationary grate elements arranged between said moving grate elements, and means for periodically elevating said relatively stationary grate elements above said moving grate elements, said elevating means being arranged beneath said grate elements and comprising operating means extending between said moving grate elements for raising and lowering said stationary grate elements periodically, said operating means comprising reciprocating parts provided with spring connections for permitting variations in the length of throw and the duration of throw.

12. A mechanical stoker comprising progressively moving grate elements, relatively stationary grate elements arranged between said moving grate elements, and means for periodically elevating said relatively stationary grate elements, said elevating means comprising links pivotally connected at their upper ends to said stationary grate elements and supported upon bearings at their lower ends, and power operated reciprocating rods provided with adjustable parts for controlling the length of throw and the duration of throw.

13. A mechanical stoker comprising progressively moving grate elements, relatively stationary grate elements arranged between said moving grate elements, and means for periodically tilting said relatively stationary grate elements, said tilting means comprising bars arranged beneath and crosswise of said grate elements, means for connecting

said bars and said relatively stationary grate elements, and operating means for said bars for raising and lowering them periodically.

14. A chain grate comprising moving chains and stationary grate bars arranged between said chains, side frames and an intermediate frame for supporting said grate, said intermediate frame being arranged beneath a grate bar in the space between two chains.

15. A chain grate comprising moving chains and stationary grate bars arranged between said chains, side frames and an intermediate frame for supporting said grate, said intermediate frame being arranged beneath a grate bar in the space between two chains and projecting below their lower stretches, cross rollers for supporting said chains arranged between said frames, said rollers being in two flights, one beneath said upper stretch and one beneath said lower stretch, and cross beams between said frames for supporting said grate bars, said cross rollers being removable from said side frames and intermediate frames.

16. In combination, a chain grate comprising endless chains spaced apart, grate bars arranged between said chains, means for moving said grate bars upwardly above said chains, side frames, an intermediate frame mounted in the space between two of said chains and beneath one of said bars, and means for supporting said intermediate frame from the foundation under the grate.

17. A chain grate comprising endless chains and grate bars arranged between said chains, side frames and an intermediate frame for supporting said endless chains and grate bars, a rotating shaft carrying said chains at one end of said grate, said shaft being mounted in bearings in said frames, and means for adjusting said shaft bearings, said adjusting means passing between said endless chains through the front of said grate.

18. The combination in a stoker, of a plurality of grate chains, means for driving said chains, and relatively stationary sectional bars located between adjacent chains, and means for actuating said sections to cause a progressively increasing projection of the sections toward the rear of said grate into the fuel bed carried by said chains.

19. A chain for a chain grate, said chain consisting of a plurality of rows of blocks, the blocks of each row breaking joint with the blocks of the next row, cross pins through the lapping ends of said blocks, and links on said cross pins beneath adjacent rows of blocks, said links bridging the gaps between the ends of blocks in the same row, and spacers between said links fitting between the teeth of sprocket wheels to support said chain.

20. A chain for a chain grate, said chain consisting of a plurality of rows of blocks, the blocks of each row breaking joint with the blocks of the next row, the tops of said blocks being wider than the bottom portions, cross pins through the lapping ends of the bottom portions of said blocks, and links on said cross pins in the spaces between adjacent rows of blocks, said links having portions adapted to engage between the teeth of sprocket wheels to support said chain.

21. An automatic stoker, a plurality of grate chains and means for driving them, and relatively stationary bars located between adjacent chains, said bars being composed of sections, and means for elevating certain of said sections above the level of the chains without affecting other sections.

22. The combination in a stoker of a plurality of grate chains spaced apart, means for actuating said chains to effect a progressive feed of the fuel, sectional grate bars interposed between adjacent chains, and means for actuating some of said sections to perfect a progressively increasing retardation of the fuel on said chains toward the rear end of the grate.

23. The combination in a stoker of a plurality of grate chains spaced apart, sectional grate bars interposed in the spaces between adjacent chains, a pair of side frame members, an intermediate frame member extending upwardly from the foundation of the stoker, means carried by said side frame members and said intermediate frame member for supporting said chains and said grate bars, means for actuating some of said sectional grate bars normally to the plane of the grate, and means for independently controlling the actuation of said sectional grate bars upon opposite sides of said intermediate frame member.

Signed at St. Louis, Missouri, this 7th day of April, 1917.

LOYD R. STOWE.