J. H. ROACH AND F. FRICK.

UNDERFEED STOKER FURNACE.

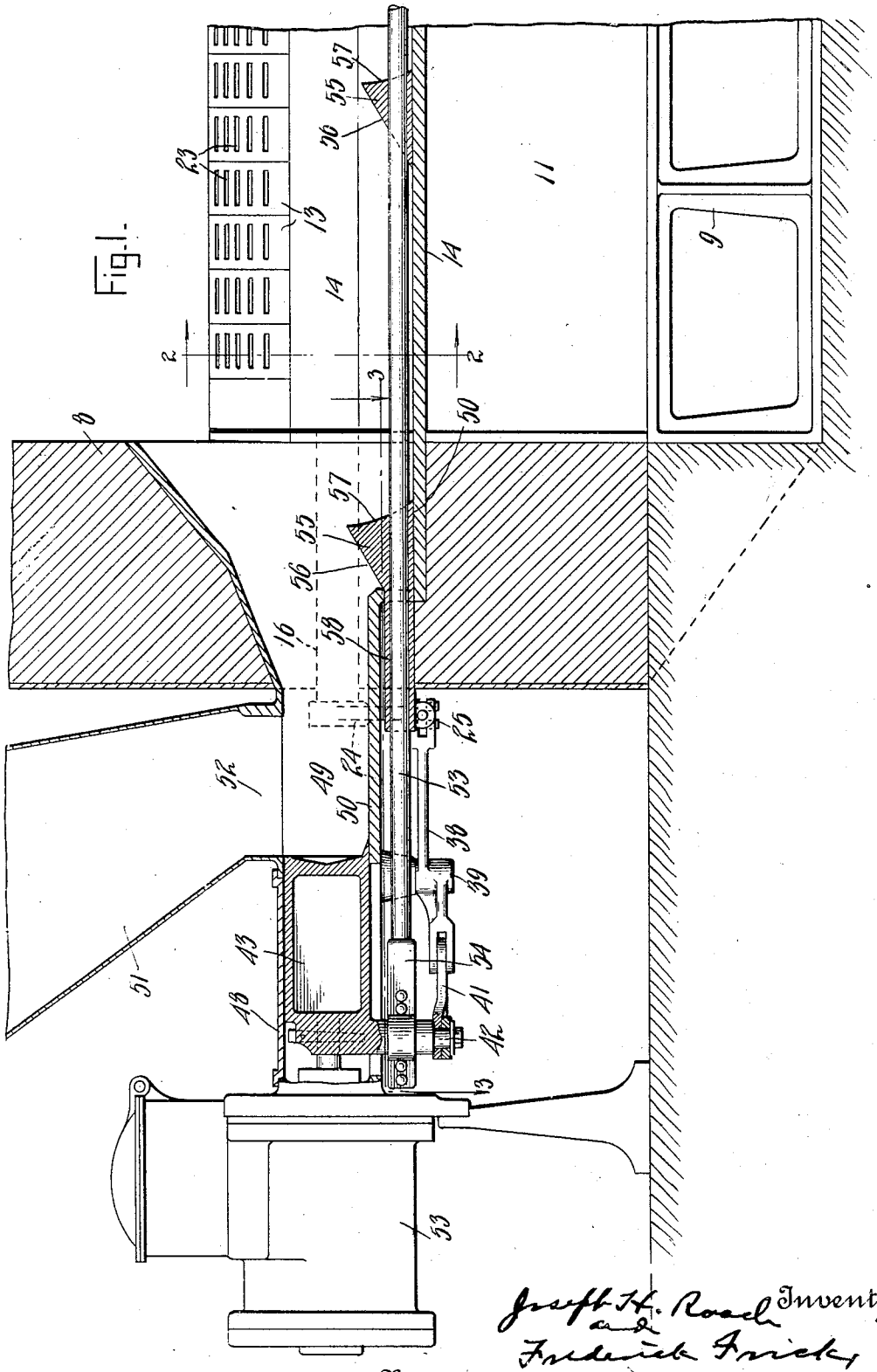
APPLICATION FILED JUNE 21, 1917.

1,321,335.

Patented Nov. 11, 1919.

3 SHEETS—SHEET 1.

Fig. 1.



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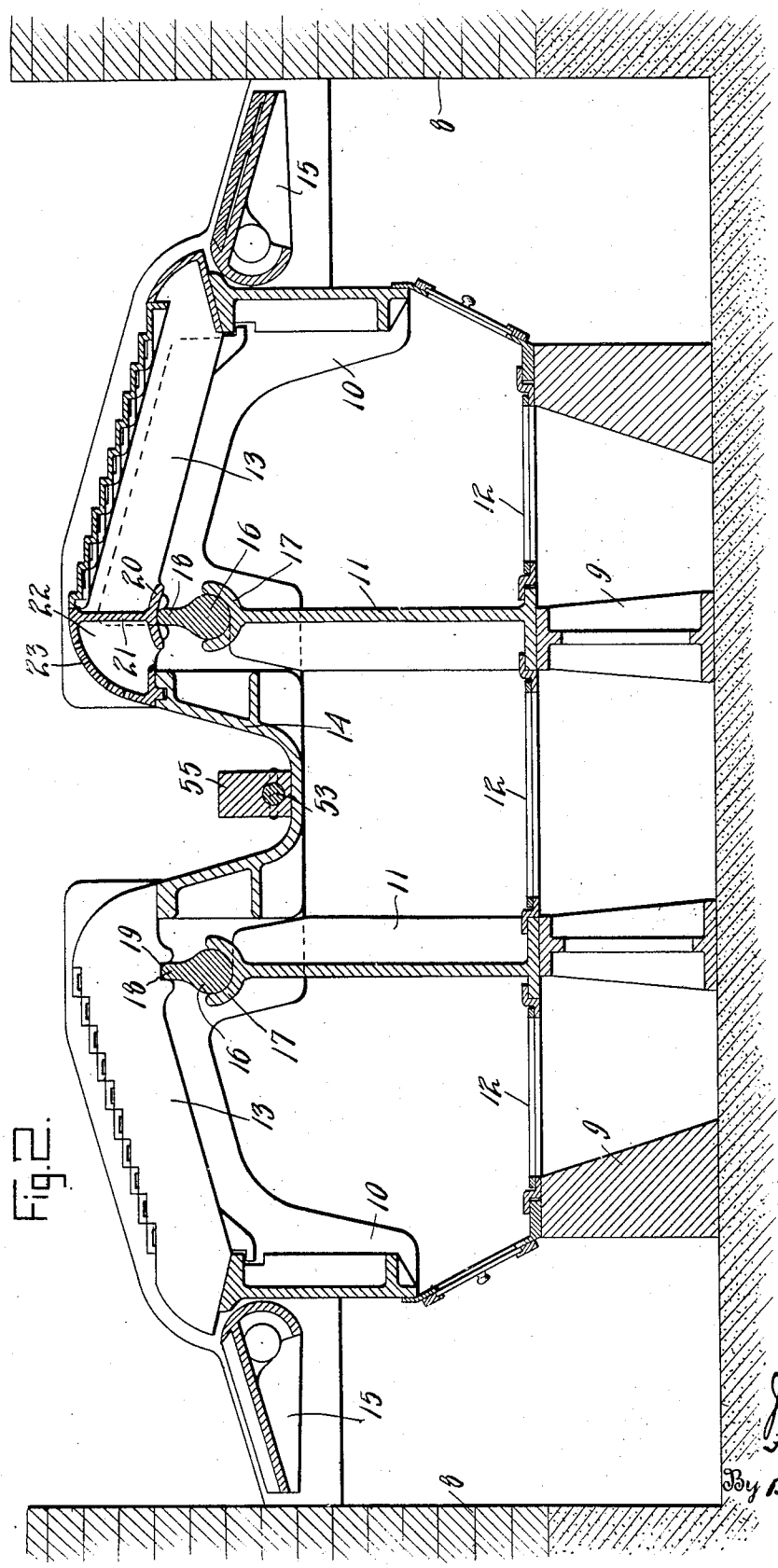


Fig. 2.

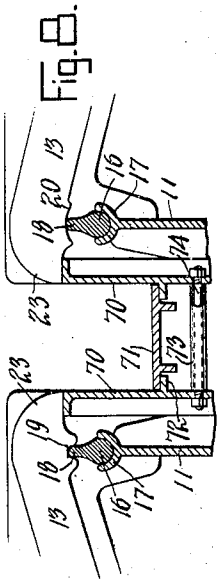


Fig. 3.

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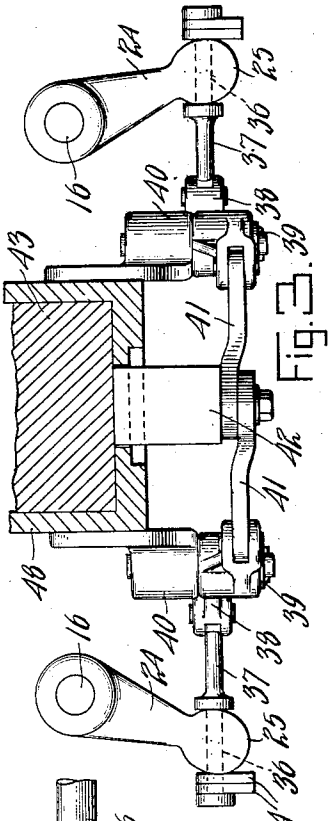


Fig. 3.

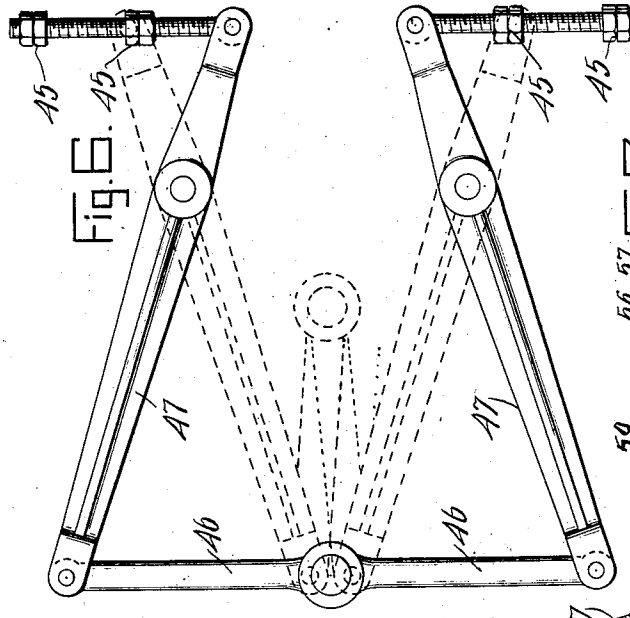


Fig. 6.

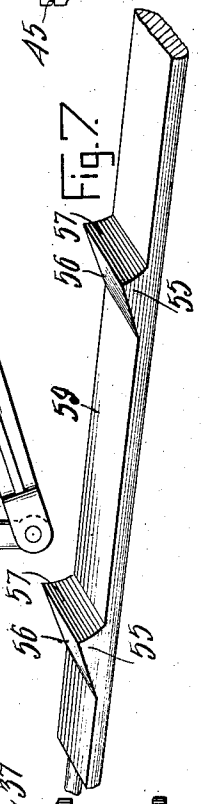


Fig. 7.

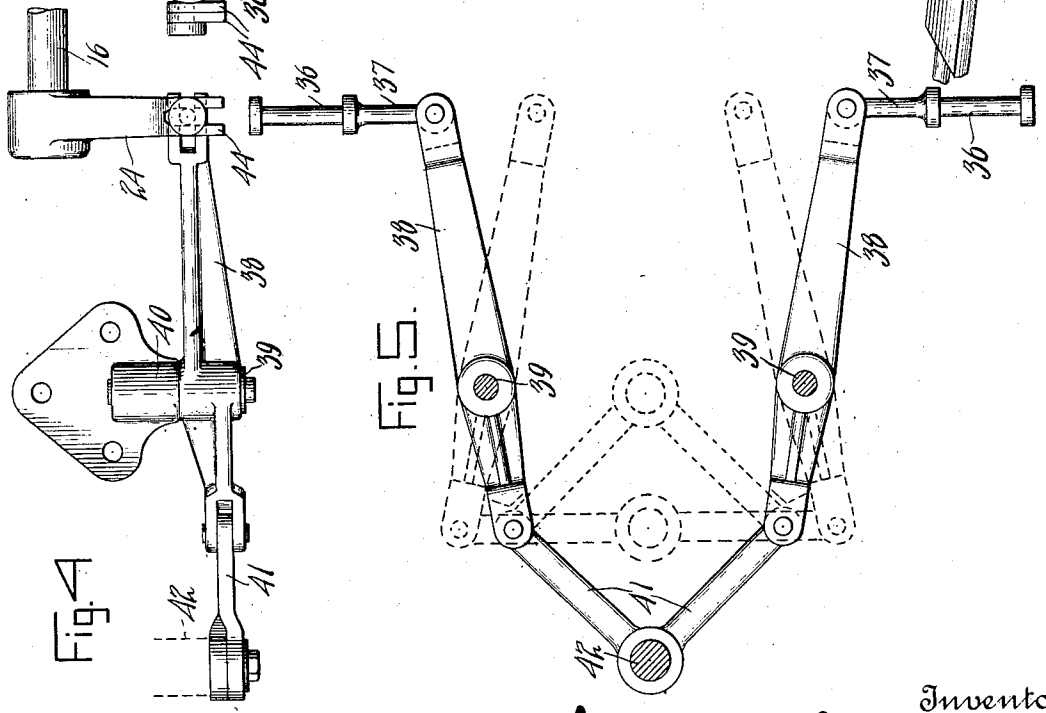


Fig. 5.

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOSEPH H. ROACH, OF BROOKLINE, AND FREDERICK FRICK, OF WAYNESBORO, PENNSYLVANIA; SAID FRICK ASSIGNOR TO SAID ROACH.

UNDERFEED-STOKER FURNACE.

1,321,335. Specification of Letters Patent. Patented Nov. 11, 1919.

Application filed June 21, 1917. Serial No. 176,240.

To all whom it may concern:

Be it known that we, JOSEPH H. ROACH, a citizen of the United States, residing at Brookline, Delaware county, and State of Pennsylvania, and FREDERICK FRICK, a citizen of the United States, residing at Waynesboro, Franklin county, and State of Pennsylvania, have invented and discovered certain new and useful Improvements in Underfeed-Stoker Furnaces, of which the following is a specification.

Our said invention relates to under-feed stoker furnaces and to the stoker apparatus *per se*, and consists in the combinations and arrangements of elements hereinafter described and particularly set forth in the accompanying claims.

The invention has for its purpose to provide a furnace in which the grate bars are actuated through the medium of the stoker mechanism, and having means whereby the movement imparted to the grate bars may be varied within a wide range of limits in accordance with the different fuels used in the furnace.

Another object of the invention consists in providing a mechanical stoker in which the stoker trunk is dropped to the level of the retort bottom to allow the secondary coal pusher to come well back into the throat of the stoker trunk and prevent coal from packing in the throat; and in which said coal pusher also forms a partially sliding bottom that assists in propelling forward the coal in the throat of the stoker trunk on the advancing movement of the coal plunger.

A further purpose of the invention consists in providing a grate draft structure having controlling means therefor arranged to secure the requisite pressures and volumes of air in the several combustion zones necessary to efficient combustion, and to this end the grate bars and the grate bar rocker shafts are constructed to provide partition elements or deflectors for directing the draft through the heaviest part of the coal bed.

The invention is disclosed by way of illustration in the accompanying drawings wherein:

Figure 1 is a longitudinal sectional view of the furnace and stoker;

Fig. 2 a transverse sectional view thereof taken on the line 2—2 in Fig. 1;

Fig. 3 a front elevational view of the grate bar actuating means;

Fig. 4 another view of the same taken at right angles to Fig. 3;

Fig. 5 a top or plan view of the mechanism shown in Fig. 3;

Fig. 6 illustrates a modified construction of the mechanism shown in Fig. 5;

Fig. 7 shows a modified form of the secondary coal pusher, and

Fig. 8 another view of a modified form of the retort trunk.

Referring to the construction in further detail and wherein like reference characters indicate corresponding parts in the different figures shown, 8 designates a suitable fire-place structure of fire bricks, or other masonary, and in which the grate structure is erected. Said structure consists of suitable supports 9 on which the walls 10 and 11 are mounted, said walls dividing the grate structure into zones or compartments through which the forced draft is admitted and controlled by a suitable sliding valve mechanism 12.

A plurality of grate bars 13 are mounted on the grate structure 10 and retort 14 (see Fig. 2), and the alternate bars of the grate are adapted to be reciprocated through the operations of the stoker mechanism. The grate bars intermediate said movable grate bars are stationary and secured in any approved manner. The usual pair of dumping grates 15 are pivotally mounted at the opposite outer ends of the grate bars as shown.

The means for operating the movable grate bars consists of a pair of rocker shafts 16 mounted to oscillate in the journal bearings 17 formed at the upper ends of the walls or partition plates 11, and each of said shafts is constructed with a flange or web portion 18 engaging within the notches 19 formed in the lower edges of the respective grate bars in such a manner that said grate bars are reciprocated when the shaft oscillates. The fixed grate bars have web portions 20 closely engaging the flanges 18 of the shafts 16, and both fixed and movable grate bars have vertically dividing walls 21 forming air passages 22 from which the forced draft issues through the ducts 23 into the heaviest part of the fuel bed; *i. e.*, directly above the retort 14. By this ar-

rangement the forced draft may be distributed in a manner conducive to the most efficient operation of the furnace, and it will be here noted that the web portions 18 of the rocker shafts 16 form partition elements continuous with the walls 11, and the dividing flanges 21 of the grate bars.

Each rocker shaft 16 is provided with a downwardly disposed arm 24 having a bifurcated end 25 that receives the end portion 36 of a rod 37, and said rod is pivotally connected to a rocker arm 38 fulcrumed at the point 39. The two rocker arms 38 are journaled in suitable brackets 40 secured to the sides of the stoker trunk (see Fig. 3) and both rocker arms 38 are pivotally connected by radius rods or toggle lever 41 to a pin 42 depending from the ram 43 of the primary stoker (see Fig. 1).

It will be seen that with this arrangement the movable grate bars are reciprocated two strokes for every given stroke of the stoker ram, and at the completion of each stroke of the ram they are brought with their inner edges flush with the inner face of the retort. And the degree or extent of each motion of said grate bars may be determined by adjustable means comprising a number of removable pieces 44 loosely mounted on the end portions 36 of the arms engaging the rods 37. These members 44 may be constructed in any manner but preferably in the form of U-shaped pieces that may be readily fitted in position on said rods, changed from one side to the other, or removed as desired. These adjusters enable the movement of the grate rocker arms to be varied as desired. It will therefore be seen that the grate bars may be set to operate within certain limits or in accordance with the character of fuel and conditions under which the furnace is working.

Instead of using the removable pieces 44 for obtaining this desired adjustment, said rods 37 may be provided with screw threaded nuts 45 and adapted to be set as conditions require (see Fig. 6). Also instead of the double motion obtained from the radius links rocker arms shown in Fig 5, said parts may be proportioned to give to the grate bars a movement stroke for stroke with the stoker. An arrangement suitable to obtain this result is shown in Fig. 6 wherein the radius links 46 are longer than as shown in 41 and in like manner the rocker arms 47 are of greater length from their fulcrum points.

The stoker mechanism consists of a primary fuel feeder located without the furnace, and a secondary feeding mechanism located within the furnace in the retort 14 and adapted to supplement the action of the primary feed mechanism.

The primary element of the stoker consists of a ram or plunger 43 movable in a trunk 48, secured to the front end of the retort 14 and having a throat portion 49 that registers with the trough of the retort. The bottom wall portion 50 of the throat 49 is dropped to the level of the bottom of said retort as shown in Fig. 1, and for a purpose to be further explained. Secured to the top of the throat 49 is a hopper 51 adapted to receive the fuel for feeding to the furnace and which communicates with the interior of the throat by means of an opening 52, said opening 52 is alternately opened and closed by the feed ram 43 as said ram is retracted and advanced.

The piston (not shown) working in the cylinder 53 operates said ram as will be understood, and there is a suitable control (not shown) for the valve gear of the ram.

The secondary feed mechanism consists of a shaft or bar 53′ preferably screw threading into the member 54 that connects with the arm 42 of the ram 43 and said shaft has suitable bearing in the dropped portion 50 of the throat 49 and at the rear end of the furnace (not shown). A plurality of coal pushers 55 are mounted at suitable intervals on said shaft 53 and work within the retort 14, and within said retort and the drop portion 50 of the throat 49.

Each of said coal pushers is constructed with a rearwardly and downwardly inclined surface 56 that operates on the outward stroke of the plunger to move through the fuel with little resistance and without appreciably carrying the fuel with it, and the front faces 57 of said pushers are recessed and disposed in a manner to propel or force the fuel forward and upward on the inward movement of the coal plunger.

By having a fuel pusher operating partly within the retort and in the dropped portion of the throat, allows said pusher to come well back into the throat of the stoker trunk and prevents coal from packing in this region, which has heretofore been a serious fault with under-feed stoker furnaces. This coal pusher is provided with a sleeve extended portion 58 that forms a partially sliding bottom which assists in propelling the coal in the throat of the stoker trunk forward on the forward movement of the coal plunger, and it will be seen that this coal plunger can be made the whole width of the stoker trunk, thus forming a sliding bottom for the entire width of the stoker trunk to assist in the forward feeding of the coal into the retort.

In the arrangement shown in Fig. 7, the several coal pushers of the secondary feed mechanism are mounted on the shaft or bar 59 as a unit. With this construction a greater agitation of the coal is secured, and there is the further advantage that the use of a separate rod is eliminated in that part of the stoker subjected to high temperature.

In Fig. 8 we have shown the retort with vertical side walls 70, having a sliding bottom 71 mounted on ledges 72. The sides are held the distance apart desired by distance sleeves 73 on the tie bolts 74. Appropriate "pushers" would be formed or adjustably secured to such a sliding bottom, as will be readily understood.

It will be noticed that the construction thus shown and described provides for applying the power to drive the ram or plunger directly behind and in line with the load, and that the motion for the grate bars is obtained from said ram or plunger operating mechanism, thus bringing the power to move the load with greatest efficiency and least resistance.

It is obvious that those skilled in the art may vary the details of construction and arrangement of parts without departing from the spirit of our invention, and therefore we do not wish to be limited to such features except as may be required by the claims.

Having thus fully described our said invention, what we claim as new and desire to secure by Letters Patent, is:—

1. In a mechanical stoker furnace the combination of movable grate bars, a stoking apparatus, and operative connections between the grate bars and the stoking apparatus whereby said grate bars operate with a double stroke for a single stroke of the stoking apparatus, substantially as set forth.

2. In a mechanical stoker furnace the combination of movable grate bars, a stoking apparatus, and a lever and toggle connection between the grate bars and the stoking apparatus whereby said grate bars operate with a double stroke for a single stroke of the stoking apparatus, substantially as set forth.

3. In a mechanical stoker furnace the combination of movable grate bars, a stoking apparatus comprising a reciprocable shaft, a pair of rocker shafts engaging said movable grate bars, toggle levers connected to the reciprocable shaft, and pivoted levers connecting said toggle levers and the rocker shafts to operate said grate bars from the stoker, substantially as set forth.

4. In a mechanical stoker furnace the combination of two sets of movable grate bars, a stoking apparatus comprising a reciprocable shaft, a pair of rocker shafts engaging said movable grate bars, a pair of depending arms mounted on the rocker shafts and having forked ends, a pair of pivotally mounted levers, members carried by said levers fitting said arm forked ends, and operative connections between said pivoted levers and the reciprocable shaft, substantially as set forth.

5. In a mechanical stoker furnace the combination of two sets of movable grate bars, a stoking apparatus comprising a reciprocable shaft, a pair of rocker shafts engaging said movable grate bars, a pair of depending arms mounted on the rocker shafts and having forked ends, a pair of pivotally mounted levers, members carried by said levers fitting said arm forked ends, removable stops on said members adapted to be engaged by the forked arms to actuate the grate bars, and operative connections between said pivoted levers and the reciprocal shaft, substantially as set forth.

6. In an underfeed stoker furnace the combination of a grate having movable grate bars, a fuel retort located in feeding relation to the grate, a stoker trunk disposed in horizontal alinement with the retort, a ram operable in the stoker trunk, a shaft connected to the ram and operable in the retort, fuel pushers mounted in said shaft, and a toggle and lever connection between said ram and the movable grate bars, substantially as set forth.

7. In an under-feed stoker furnace the combination of a grate having movable grate bars, a fuel retort located in feeding relation to the grate, a stoker trunk disposed in horizontal alinement with the retort, a ram operable in the stoker trunk, a shaft connected to the ram and operable in the retort, fuel pushers mounted on said shaft, a pair of levers fulcrumed on the stoker trunk and connected to said movable grate bars, and a pair of toggle links carried by the plunger connected to said levers to actuate the grate bars, substantially as set forth.

8. An under-feed stoking apparatus, comprising a frame, a retort, grate bars movable at right-angles to the retort, a plunger for feeding the coal to the retort, a power means consisting of a fluid cylinder mounted directly back of the plunger, a reciprocating piston in said cylinder, a piston rod connecting said piston with said plunger, whereby the power is located directly back of the load, and operative connections between the plunger and the grate bars, substantially as set forth.

In witness whereof, we have hereunto set our hands and seals at Philadelphia, Pennsylvania, this 18th day of June, A. D., nineteen hundred and seventeen.

JOSEPH H. ROACH. [L. S.]
FREDERICK FRICK. [L. S.]

Witnesses:
MAY N. SUTCLIFFE,
RALPH PEACE.