

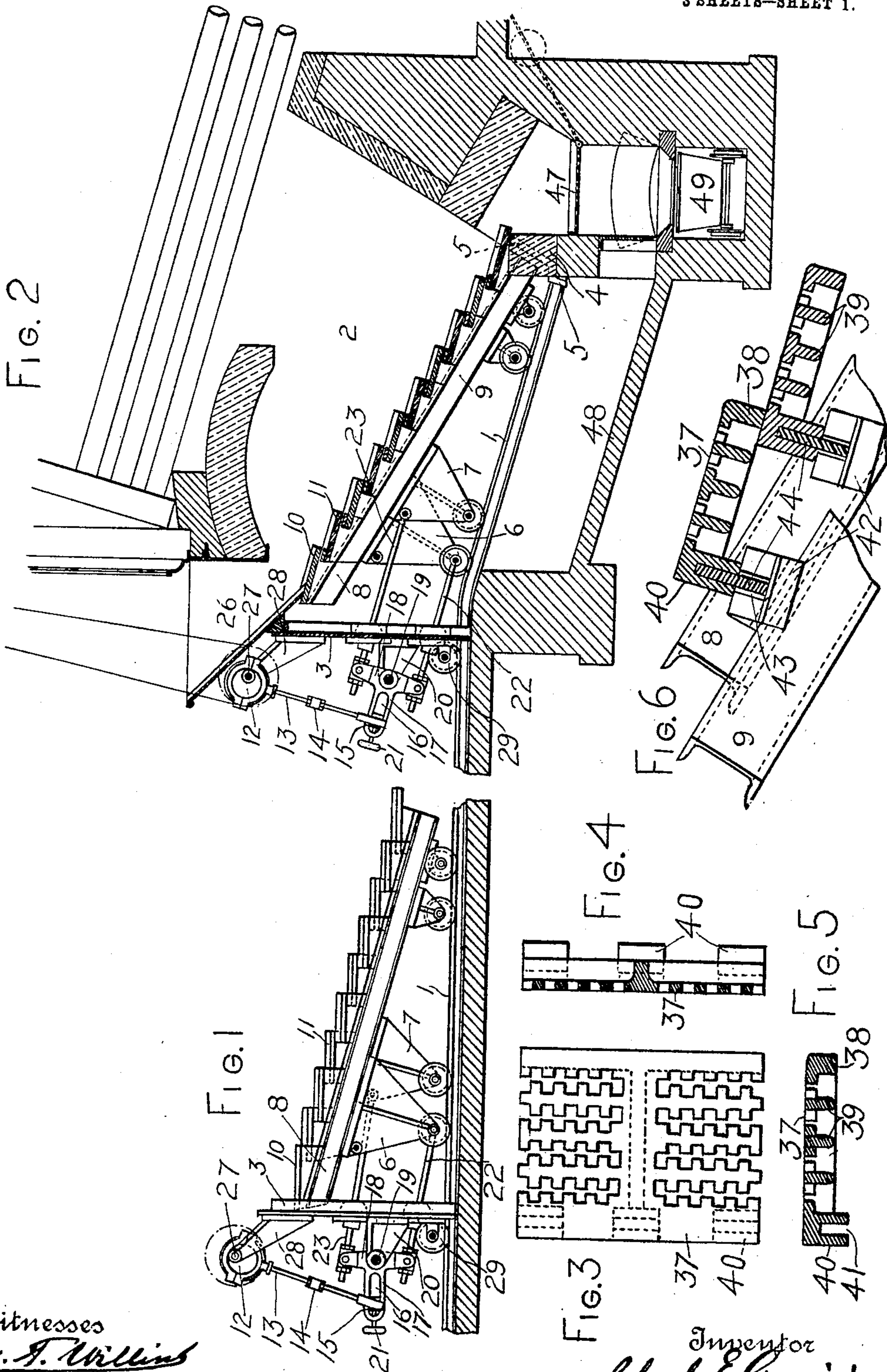
No. 795,388.

PATENTED JULY 25, 1905.

C. E. GOOGINS.  
RECIPROCATING TERRACED FURNACE GRATE.

APPLICATION FILED JULY 27, 1904.

3 SHEETS—SHEET 1.



Witnesses  
*Aug. T. Williams*  
*Geo. C. Jones*

Inventor  
*Charles E. Googins*

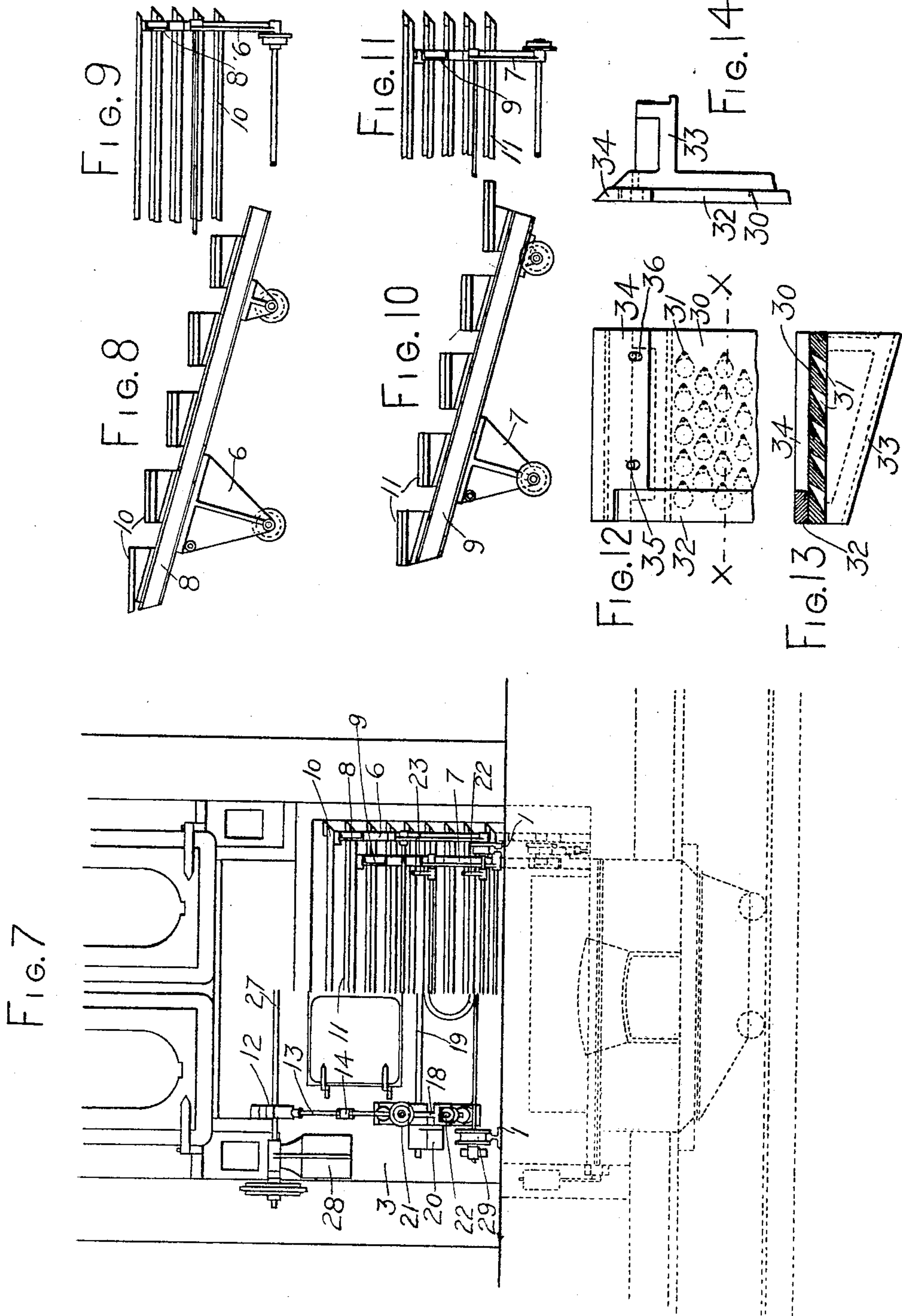
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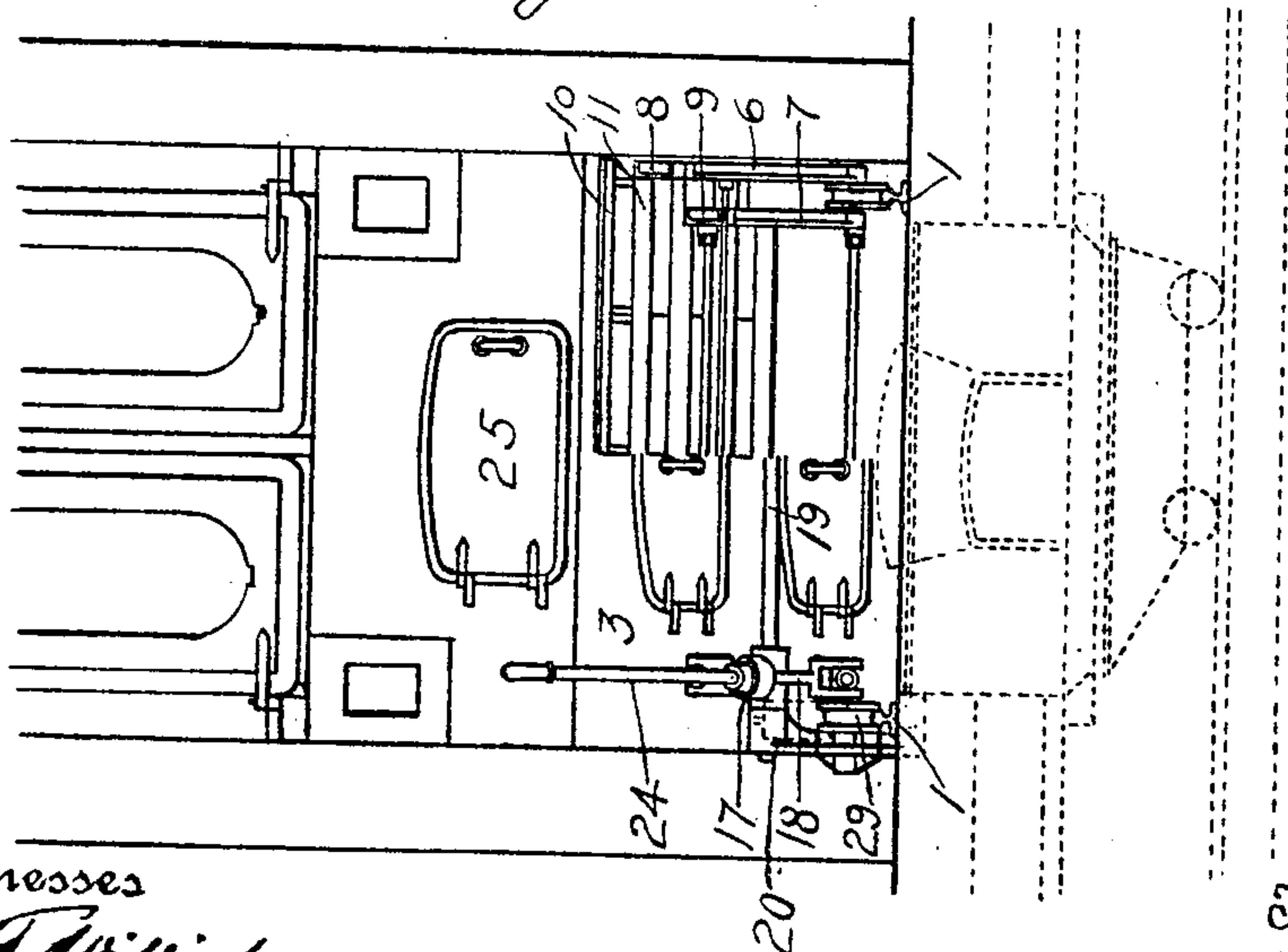
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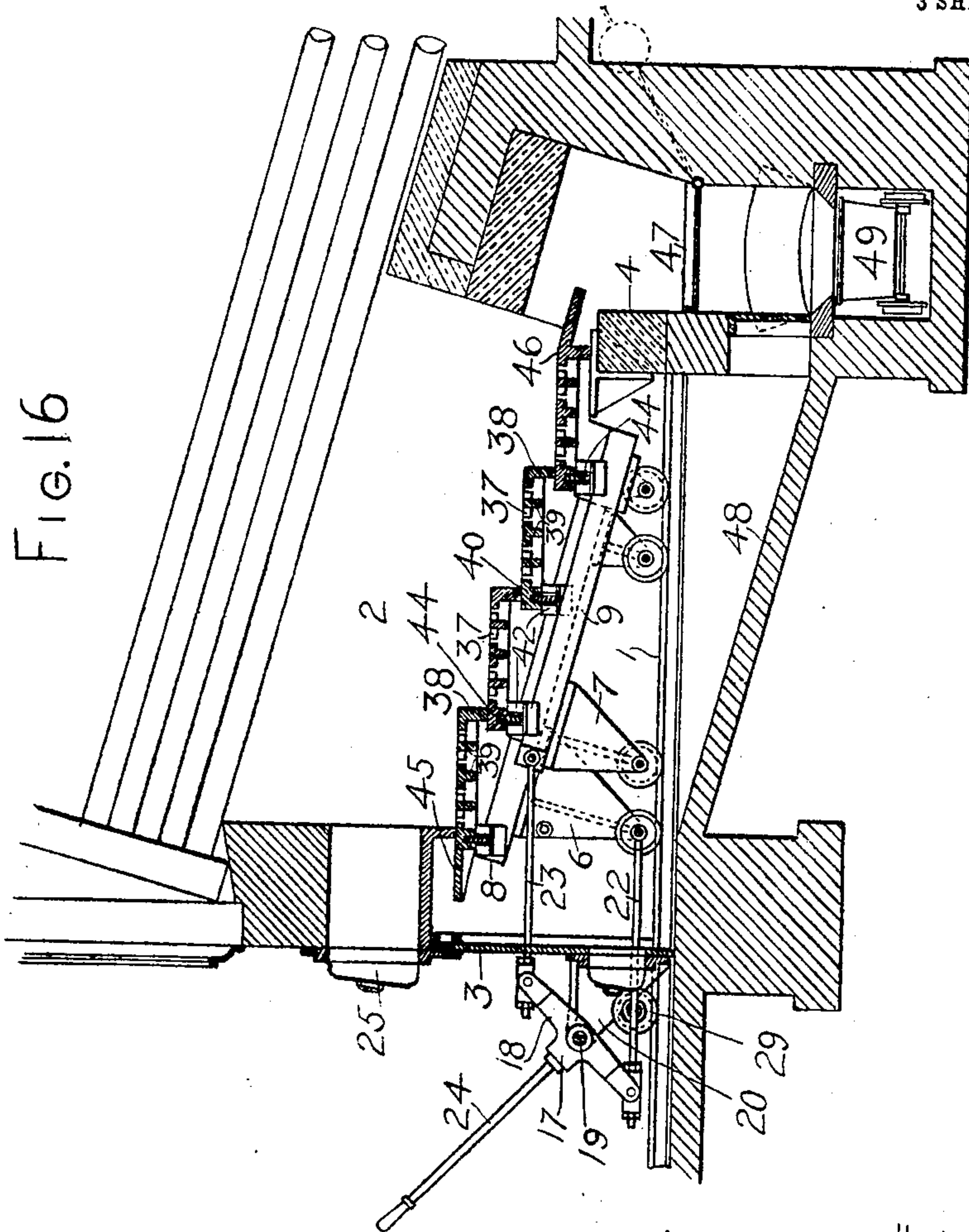
3 SHEETS—SHEET 3.

FIG. 15



Witnesses  
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# UNITED STATES PATENT OFFICE.

CHARLES EDGAR GOOGINS, OF BROOKLYN, NEW YORK.

## RECIPROCATING TERRACED FURNACE-GRATE.

No. 795,388

Specification of Letters Patent.

Patented July 25, 1905.

Application filed July 27, 1904. Serial No. 218,402.

*To all whom it may concern:*

Be it known that I, CHARLES EDGAR GOOGINS, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Reciprocating Terraced Furnace-Grates, of which the following is a specification.

My invention relates to reciprocating terraced furnace-grates—that is to say, it immediately belongs to the particular class of grates usually employed in connection with steam-boilers wherein the grate bars or portions are substantially shelves upon which the burning fuel lies. As ordinarily constructed the highest shelf is placed nearest the furnace-door and slightly overlaps the next inward and lower shelf. A descending series of shelves or terraced surfaces of any desired extent is thus created, and upon giving the shelves, by sets or individually, occasional or repeated forward and backward movement in any degree and in such manner that contiguous shelves always move oppositely the fuel is adequately shaken and caused to descend as consumed from the highest to the lowest shelf and ultimately to the ash-carrier.

My invention has for its object the production of apparatus of the nature mentioned, embodying certain parts having special construction and arrangement permitting them to be easily removed for repairs or when necessary to be replaced by new parts.

It is also an object of my invention in the special construction and arrangement of parts to avoid friction when the terraces or shelves move with respect to each other in order that but little power may be demanded in the operation.

I accomplish the objects set forth by forming and associating the parts as illustrated in the accompanying drawings, of which—

Figure 1 represents a side view of the grate-cars and removable front wall withdrawn and standing upon the level track before the boiler. Fig. 2 is a vertical section through the boiler-foundation, bridge-wall, crown-wall, grate, and removable front wall and shows both cars within the furnace. Figs. 3, 4, and 5 are respectively a plan view, a longitudinal sectional view, and a cross-section of one form of grate used in connection with my invention. Fig. 6 illustrates one manner of attaching the grate, set out in the preceding figures, upon the side beams of the grate-cars. Fig. 7 is a view of the boiler-front,

part of the removable wall being omitted to disclose mechanism otherwise hidden. Fig. 8 is a side view of the larger outer car and shelves; and Fig. 9 represents a fragmentary end view thereof, taken from the left of Fig. 8. Fig. 10 is a side view of the smaller inner car and shelves, and Fig. 11 is a fragmentary end view from the left of Fig. 10. Figs. 12, 13, and 14 illustrate a particular form of grate terrace or shelf employed by me under certain conditions hereinafter explained and represent, respectively, a partial plan, a cross-section on the line X X of Fig. 12, and a fragmentary edge view taken from the right of Fig. 12. Fig. 15 is a face view of the boiler-front with a portion removed to exhibit parts in rear, and shows mechanism whereby the grates may be operated by hand. Fig. 16 is a vertical section lengthwise of boiler-housing and grate and shows the invention arranged for hand-firing and hand-operating. In Figs. 15 and 16 the track for the grate-cars is horizontal both within and without the furnace.

Like numbers are used to refer to the same parts throughout the drawings.

The track-rails (marked by numeral 1 in the drawings) extend from within the furnace 2 through the removable front wall 3, to be again mentioned, and any desired length of track is laid outside the boiler, as illustrated. That portion of the track within the furnace may be inclined (see Fig. 2) or the track may be entirely level. (See Figs. 15 and 16.) It is my usual practice to incline the furnace-track when the invention is power-operated and to build a level track when the parts are to be actuated by hand. Such arrangements are not, however, strictly necessary, as either means for operating the grates may be employed with either a level or inclined furnace-track.

I do not limit myself to any particular arrangement of the furnace-walls or boiler, excepting when the inclined furnace-track is used a portion of the rear wall 4 of the furnace is built up slightly higher than the track-rails 1 and a buffer-plate 5 is set in the wall to limit the downward movement of the cars in case they should become released in front.

There are two grate-cars, (designated by numerals 6 and 7). Of these car 6 is the higher and outermost and car 7 the inner and lower one. Car 6 is provided with twin parallel side beams 8, and car 7 has like beams, (marked 9.) The terraces or shelves—that is to say, the grate portions—for car 6 are referred to



by number 10 and those of car 7 by number 11. It will be noted that the inclined side beams of car 6 lie outside those of car 7 (see Figs. 1, 2, and 7) and that the grate-shelves of each car slightly overlap the edges of the adjacent shelves of the other car. Attention is also called to the fact that while the wheels of both cars run upon the same rails 1 the cars are in all respects capable of independent, although limited, movement with respect to each other. In the form of device illustrated in Figs. 1, 2, and 7 the necessary movement is imparted by means of the eccentric 12, having the rod 13 provided with the extensible connection 14. The eccentric-rod pivotally engages a block 15, sliding in a slot 16, formed lengthwise in the shank 17 of a rocking T (marked 18) upon the rocking shaft 19, the shaft being supported in suitable bearing-brackets 20, secured to the removable front wall 3. Sliding block 15 is adjustable in the slot toward or from the rocking shaft by hand-screw 21, and the nearer it is placed to that shaft the less will be the movement given the cars by the operating eccentrics and rods and connecting-rods 22 and 23, pivotally attached to cars 7 and 6 and to the ends of the cross-pieces of each rocking T. It is thought to be now clear that equal but opposite reciprocating movements are given the cars in equal times. Vertical slots permit the passage of connecting-rods 22 through front wall 3 and afford space for them to play.

In Figs. 15 and 16 the shank of the rocking T is shown as modified to afford a socket for the bar 24, and the cars are thus moved by hand. In Fig. 16 it is contemplated that the furnace shall be fed by hand through door 25; but in Fig. 2 a hopper 26 is illustrated and the feed is continuous, the reciprocating movement being constantly repeated by the power-operated devices, whereas when the grates are hand-operated the movement is given them occasionally only as the fuel needs to be shaken to promote combustion. The operation is substantially the same in both instances.

In the preferred construction shown in Figs. 1, 2, and 7 and in the modification set out in Figs. 15 and 16 it will be understood that the normal positions of the two cars with respect to each other and to the rear or ash-cavity wall 4 may be adjusted by setting each rocking T in a given position. For example, considering Fig. 1, let the eccentric-rod be shortened without disturbing the block 15 in slot 16 of the rocking T. Obviously the shank 17 will be raised and the T tilted, thereby moving the cars oppositely and decreasing the lap of the shelves. If this new position be regarded as the normal when the eccentric-rod is at its lowest place, then a new normal position will be attained when the rod is in its highest altitude, and the mean position of each car with regard

one to the other will have been changed correspondingly.

Eccentrics 12, of which there are two placed near the sides of the boiler-front, are fixed upon the transverse shaft 27, and the bearing-brackets 28, attached to the removable front wall 3, support the shaft. At its lower corners and engaging the rails 1 the removable front wall 3 is provided with the wheels 29. It is, in fact, mainly supported upon those wheels, and when the cars are pulled out upon the rails before the boiler (see Fig. 1) the front wall 3, carrying the eccentrics and the rocking T's, with their attachments, precedes the cars and is replaced with them. This feature of the operation is the same whether the rails be continuously level or inclined in the furnace, as described.

When my invention is constructed to be power-operated and forced draft used, I employ a form of grate-shelf fashioned substantially as illustrated in Figs. 12, 13, and 14. The floor of the shelf 30 is provided with the tapering air-ducts 31, having any desired number and arrangement. At the front edge (the word "front" being used to mean that edge toward the front of the boiler) is located the edge bar 32. These edge bars 32 ordinarily are equal in width to the lap of the shelves of the two cars—that is to say, the shelves 11 of car 7 extend beneath the shelves 10 of car 6, and vice versa, as ordinarily constructed a distance approximately equaling the width of the edge bars when the entire series of shelves is elongated to the maximum. The reference-number 33 marks the slanting end flange of the grate-shelf, by which it is secured upon the side beams 8 and 9. In Fig. 2 it is shown that the shelves may have a slight inclination away from the boiler-front. They are parallel to the horizontal plane of the track-rails. In this Fig. 2 it is also indicated that the edge bars 33 do not quite touch the bottoms of the shelves immediately above them. Therefore no rubbing friction occurs, and enough power only is needed to move the cars with their loads of fuel. In Figs. 12, 13, and 14 will be further observed the movable plate 34 at the end of each shelf. This plate prevents the fuel from falling off the end of the shelf, as it is situated close to the side wall of the furnace. Should the longitudinal expansion of the shelf bring the edge of the movable plate 34 against the side walls, no harm results, as the pins 35, holding the plate on the shelf, pass through slots 36, and the probable expansion is thus provided for, while at the same time any openings between the ends of the shelves and the side walls are sufficiently closed by the plate.

When my invention is constructed to be operated either by power or by the hand-bar 24 and under natural draft, I employ a more open grate. Such a grate is illustrated in Figs. 3,



4, 5, and 6. I do not wish to be understood as confining myself to the precise pattern delineated, but may change the parts in shape. An open grate is the only essential. The type of grate illustrated is very convenient. It is made in divisions, reference-number 37 marking one of any number of divisions. They are hollow beneath and have the edge bar 38 and intermediate bars 39 extending lengthwise and formed integrally with the remaining features. The front edge is provided with blocks 40 at intervals, and each block has a recess 41. To support the grate-divisions 37 upon the side beams of the cars, I introduce the cross-pieces 42, which possess recesses 43, corresponding in position to those in the blocks 40. By inserting a locking-plate 44 in the recesses of the blocks and cross-pieces the divisions of the grate are removably held in position. (See Fig. 6.) Upon the failure of any grate-division from any cause it may be easily removed and a new one substituted, and this exchange can be accomplished without drawing the fire. In using the form of grate just described I do not construct all the divisions throughout in precisely the same shape. It will be noted in Fig. 16 that the front divisions 45 and the rearward divisions 46 are furnished with projecting lips. The lips of the divisions 45 extend beneath the inner edge of the furnace-door, and the lips of the divisions 46 lie over the wall 4 at the rear. Thus extended the lips enable the surfaces of the grate-divisions to receive the fuel when delivered in at the furnace-door and to discharge the burned-out residue over the rear wall 4 without spilling.

The operation of my invention is as follows: Considering Fig. 1, the assembled cars and front wall 3 are run into the furnace and occupy the positions illustrated in Fig. 2. The machinery is started, causing a steady reciprocative movement of the cars. Fuel received from the hopper upon the highest terrace or shelf of car 6 is shaken, partly ignited, upon the underlying shelf of car 7 and more fuel received upon the first shelf. Thus step by step the burning fuel is moved rearwardly upon each shelf by the edge of the shelf next above it until finally when entirely consumed the ashes fall over wall 4 upon the balanced pan 47, which normally closes the opening and permits no air to enter the furnace excepting through the grate and fuel and which dumps when loaded and recovers its position. Any ash falling directly from the grate is received upon the slanting floor 48 of the ash-pit and gravitates into the carrier 49 with the remaining residue.

Having thus described my invention and explained the manner of its operation, what I claim is—

1. In a reciprocating terraced furnace-grate, the combination with independently-movable cars having inclined side beams, of

grate-shelves borne by the said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, mechanism whereby said cars may be oppositely reciprocated, and devices adapted to support and transport said mechanism, the said cars, reciprocating mechanism and supporting devices being collectively movable from and to the furnace.

2. In a reciprocating terraced furnace-grate, the combination with independently-movable cars having inclined side beams, of grate-shelves borne by the said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, track-rails extending within and without the furnace, mechanism whereby said cars may be oppositely reciprocated, and devices adapted to support and transport said mechanism, the said cars, reciprocating mechanism and supporting devices being collectively movable upon said rails from and to the furnace.

3. In a reciprocating terraced furnace-grate, the combination with independently-movable cars, of grate-shelves borne by said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, a removable front wall, and mechanism attached to and carried by said wall whereby said cars may be oppositely reciprocated, the said cars, reciprocating mechanism and front wall being collectively movable from and to the furnace.

4. In a reciprocating terraced furnace-grate, the combination with independently-movable cars, of grate-shelves borne by said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, track-rails extending within and without the furnace, a removable front wall having supporting-wheels engaging said rails, and mechanism attached to and carried by said wall whereby said cars may be oppositely reciprocated, the said cars, reciprocating mechanism and front wall being collectively movable from and to the furnace.

5. In a reciprocating terraced furnace-grate, the combination with independently-movable outer and inner cars, of track-rails extending within and without the furnace and inclined within the furnace, grate-shelves borne by the said cars, the surfaces of said shelves being arranged parallel to the portion of the track within the furnace, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, a removable front wall having supporting-wheels engaging said rails, and mechanism attached to and carried by the said wall whereby the said cars may be oppositely reciprocated, the said cars, re-



reciprocating mechanism and front wall being collectively movable from and to the furnace.

6. In a reciprocating terraced furnace-grate, the combination with independently-movable cars, of grate-shelves borne by said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, adjustable mechanism whereby said cars may be oppositely reciprocated, and devices adapted to support and transport said mechanism, the said cars, reciprocating mechanism and supporting devices being collectively movable from and to the furnace.

7. In a reciprocating terraced furnace-grate, the combination with independently-movable cars, of grate-shelves borne by said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, a removable front wall, mechanism attached exteriorly to and carried by said wall, and connections passing through the said wall whereby the cars may be oppositely reciprocated, the said cars, reciprocating mechanism, connections, and front wall being collectively movable from and to the furnace.

8. In a reciprocating terraced furnace-grate, the combination with independently-movable cars having inclined side beams, of cross-pieces recessed longitudinally and secured to the side beams, grate-shelf divisions having blocks recessed correspondingly with

said cross-pieces, a locking-plate engaging the recesses of said cross-pieces and blocks and holding said grate-divisions removably in position, the said divisions forming grate-shelves, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, mechanism whereby said cars may be oppositely reciprocated, and devices adapted to support and transport said mechanism, the said cars, reciprocating mechanism and supporting devices being collectively movable from and to the furnace.

9. In a reciprocating terraced furnace-grate, the combination with independently-movable cars, of grate-shelves borne by said cars, the shelves borne by one car being arranged alternately and in overlapping relation with the shelves borne by the other car, the said shelves each comprising detachable divisions, mechanism whereby said cars may be oppositely reciprocated, and devices adapted to support and transport said mechanism, the said cars, reciprocating mechanism and supporting devices being collectively movable from and to the furnace.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES EDGAR GOOGINS.

Witnesses:

A. B. SMITH,

W. J. BOWMAN.