

No. 657,679.

Patented Sept. 11, 1900.

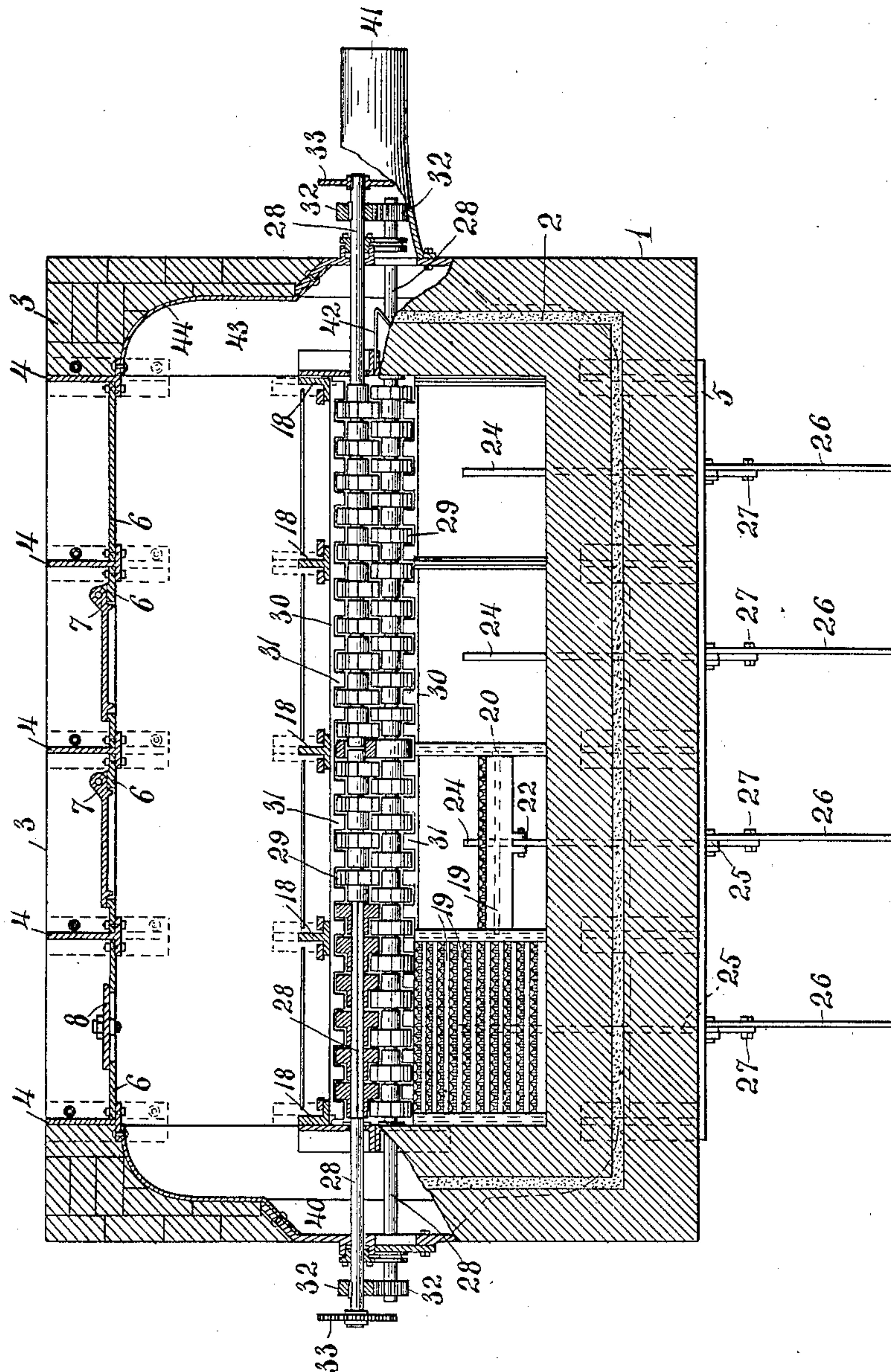
J. G. SANDERSON.
FURNACE.

(Application filed July 17, 1899.)

(No Model.)

4 Sheets—Sheet 1.

FIG. 1.



WITNESSES

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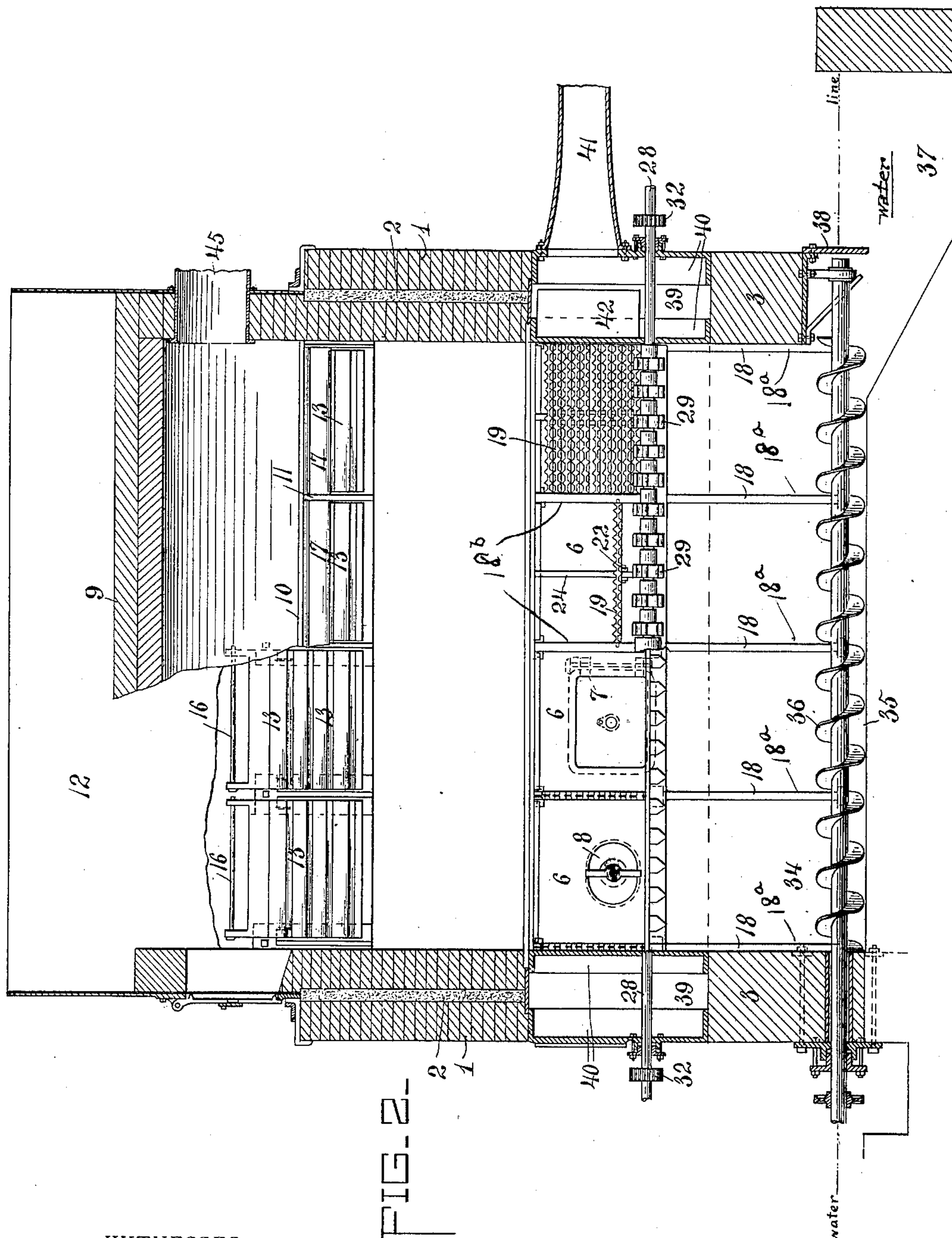


FIG-2-

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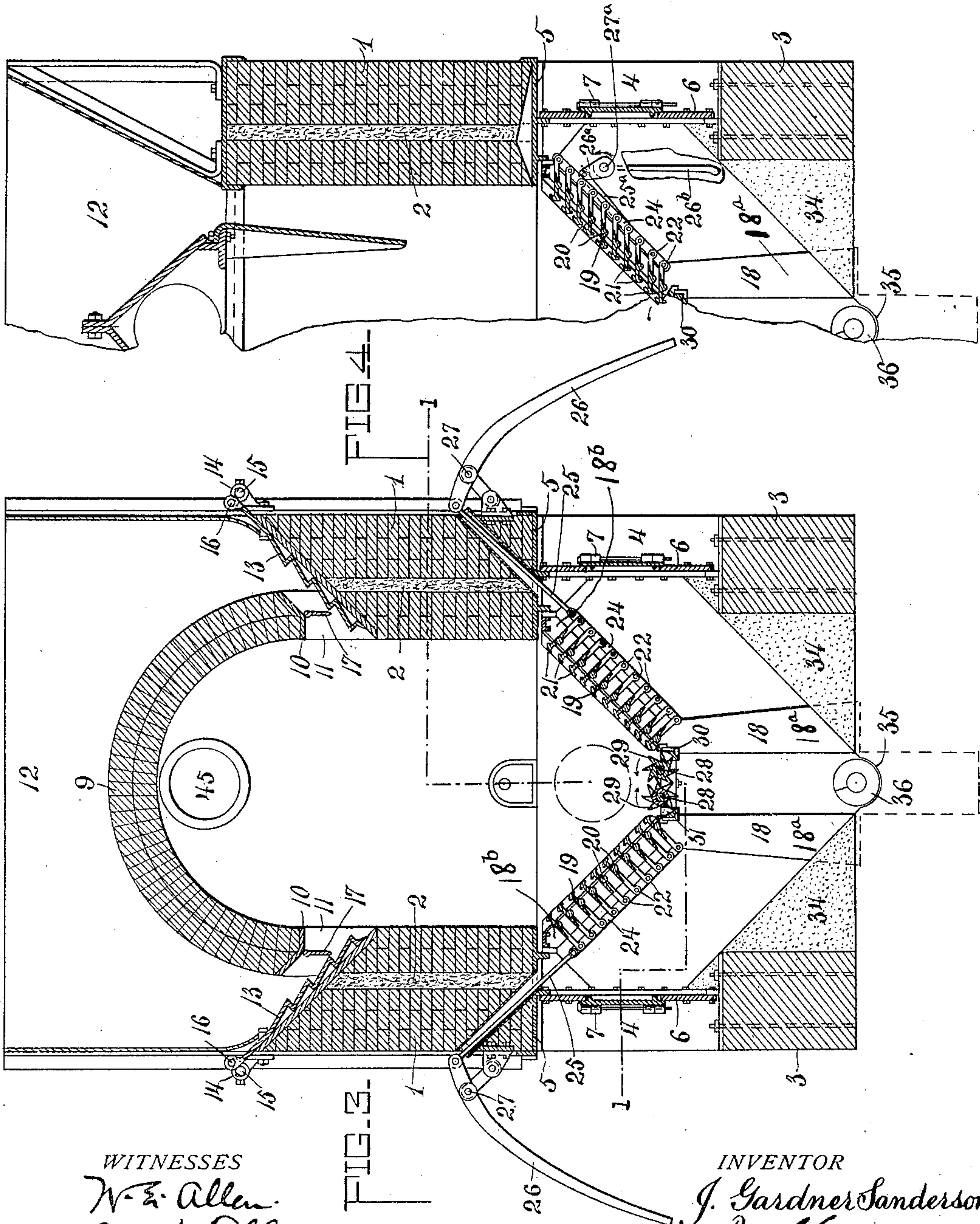
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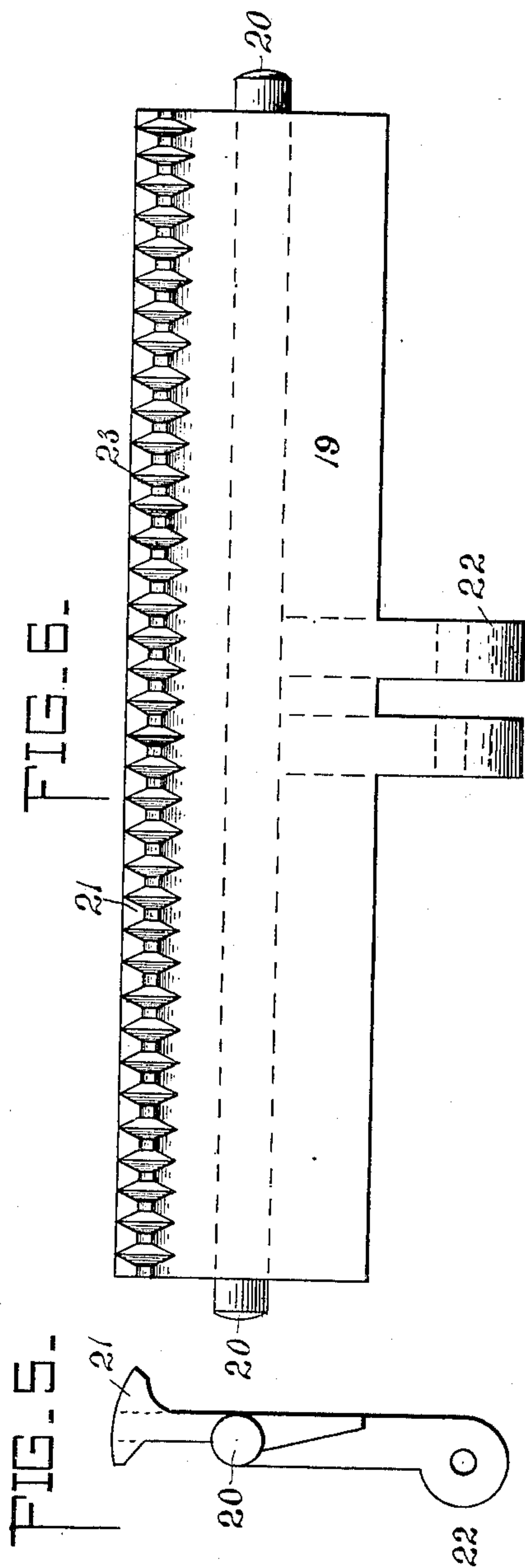
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4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE

JAMES GARDNER SANDERSON, OF SCRANTON, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 657,679, dated September 11, 1900.

Application filed July 17, 1899. Serial No. 724,129. (No model.)

To all whom it may concern:

Be it known that I, JAMES GARDNER SANDERSON, a citizen of the United States, and a resident of Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to furnaces for the combustion of small or fine fuel, such as waste coal or slack, anthracite culm, and coke-breeze; and it has for its object to provide improved means for handling these forms of fuel both in feeding it into the furnace and causing complete combustion thereof; also, to improve the general construction of a furnace suitable for burning such fuel.

One feature of my invention consists in providing the passage-way between the fuel-hopper and the interior of the furnace with a stepped or ribbed feeding-plate which is intermittently reciprocated, so as to gradually force the fuel into the furnace, a suitable valve cooperating with said plate to close the entrance and prevent escape of gas.

Another feature of my invention consists in constructing the fuel-grate of a number of superimposed trunnioned plates projecting successively beyond one another to form an inclined grate-surface suitably spaced apart for the free passage of air between them and each presenting in normal position an approximately-horizontal portion to support the fine fuel, the plates being preferably provided with longitudinal ribs or enlargements, which have the effect of raking off a restricted portion of the fuel when the plates are rocked upon their trunnions into approximately-vertical position and also serve to substantially close the openings between the plates by such movement and prevent discharge of unconsumed fuel. The enlargements are preferably serrated or notched to avoid cutting off the supply of air during the stoking operation, and their reciprocating movement upon their trunnions serves the additional function of feeding downward any ash which is too large to pass between them.

A further feature consists in providing at the bottom of the fire-pot formed by the two inclined grates above described a clinker

grinder and discharger, comprising two shafts carrying laterally-contiguous intermeshing spur-wheels set in a mounting or frame having projections entering and guarding the spaces between the spur-wheels on the outer sides of the respective shafts.

A further feature consists in providing a centrally-disposed ash-trough beneath the fire-pot, in which is mounted a worm-screw, and an ash-pit into which the trough discharges and which is suitably water-sealed.

Further features relate to the specific construction of the body of the furnace, whereby the necessary flues for supplying air and steam to support combustion are provided in an advantageous manner.

In the accompanying drawings, Figure 1 is a horizontal section through a furnace embodying my present invention, the section being taken upon the line 1 1 of Fig. 3 and some of the grate-bars being omitted for perspicuity. Fig. 2 is a central longitudinal vertical section in which some of the grate-bars and a portion of the arch-wall are omitted to disclose parts behind them. Fig. 3 is a vertical transverse section of my improved furnace, showing one means for oscillating the grate-bars upon their trunnions, together with the preferred form of fuel-feeding mechanism. Fig. 4 is a partial vertical section illustrating another means for oscillating the grate-bars and showing a modified form of fuel-feed. Figs. 5 and 6 represent by end view and side elevation, on an enlarged scale, the construction of my improved trunnioned grate-bars.

1 represents the walls of the furnace, preferably constructed with a non-conducting filling 2 and supported on foundation 3 through the medium of posts 4 and plates 5. The spaces between posts 4 are closed by panels 6, containing either doors 7 or man-holes 8.

9 represents the arch, supported upon the furnace-walls 1 through the medium of a frame 10 of a construction which provides a number of fuel-feed passages 11, through which the surmounting fuel-hopper 12 communicates with the furnace. Fuel is fed automatically and in measured quantities controllable at will by means of the stepped or

ribbed plates 13, working in the passages 11. The plates 13 have downwardly-presented shoulders which engage measured quantities of the fuel in that direction and cause it to pass into the furnace. The plates 13 are moved upward by cams 14 on constantly-rotating shafts 15, which engage pins 16 in the protruding ends of the plates beyond the walls of the furnace and in the opposite direction by gravitation of the superimposed column of fuel. Valves 17 cooperate with the plates 13 to close the openings 11 against the escape of gas.

While the above-described feed apparatus is preferable, I may employ a chute substantially as shown in Fig. 4, which projects into the furnace and is flared downwardly to overcome tendency to packing of the material and choking of the passage. Such a feed apparatus is disclosed in my Letters Patent No. 609,705, granted August 23, 1898.

The fire-pot is formed by two lateral grates inclined downwardly toward its center, which is closed by a clinker grinder and discharger. Each grate is divided into longitudinal sections by knees 18, having parallel vertical portions 18^a and diverging portions 18^b, and between each pair of knees are trunnioned peculiarly-formed grate-bars 19. The form of one of these grate-bars will be understood upon reference to Figs. 5 and 6, from which it will be observed that they are provided with trunnions 20, toothed or serrated enlargements 21 along their inner edges, and a pair of perforated ears 22 for the attachment of a connecting-bar through the medium of which the grate-bars are oscillated. The normal position of the grate-bars is that shown in Fig. 4, where it will be observed that they are spaced apart vertically to permit the free passage of air between them, and they project successively beyond one another in a downwardly-extending series to afford vertical support for the superincumbent fuel. By such a construction of grate the downward tendency of the fuel is effectually arrested until the grate-bars are oscillated, when the downward feeding of any adjacent material, such as clinker too large to pass between the grate-bars, is caused to take place. The longitudinal enlargements 21 of the grate-bars are such that when the latter are moved to a position approximating that shown in Fig. 3 the ashes or consumed fuel contiguous to the grate, where combustion takes place, will be raked off or gathered and caused to drop between the bars, while by the same operation the spaces are substantially closed against the passage of unconsumed fuel, and the latter is afforded vertical support. A return of the grate-bars to the position shown in Fig. 4 causes the clinker, &c., to feed downwardly, as before explained. By the serrations or notches 23, formed in the enlargements of the grate-bars, interference or material reduction of the supply of air or

other support for combustion is prevented, while not impairing the function of the enlargements 21 in preventing waste of unconsumed fuel.

Oscillating movement may be imparted to the grate-bars 19 in various ways. I have illustrated in Fig. 3 a bar 24, connecting all of the ears 22 and having direct connection through a pitman 25 with an operating-lever 26, fulcrumed at 27 on the outside of the furnace, so that the grate-bars may be manually oscillated at will. The connecting-bar 24 may, however, be connected through a pitman 25^a with a lever 26^a on a shaft 27^a, which extends longitudinally through the wall of the furnace and is there provided with means for actuating it—such, for instance, as a handle 26^b.

The clinker grinder and discharger, located at the angles of the knees at the bottom of the fire-pot, comprises a pair of shafts 28, toothed wheels 29, and longitudinal bars 30, formed with projections 31, the wheels on the shafts and the projections on the bars being spaced apart a distance corresponding approximately to the thickness of the wheels and so located that the teeth of the wheels and projections on the bars overlap, the teeth on the wheels of one shaft entering and guarding the spaces between the wheels on the other shaft and the projections on the bars entering and guarding the spaces between the wheels on the outer sides of the shafts. The shafts 28 extend longitudinally through the furnace and are caused to rotate in unison by intermeshing gear-wheels 32 at one or both ends, rotary motion being imparted through any suitable means—such, for instance, as a sprocket-wheel 33, which is to receive motion from any suitable source.

Ashes and ground clinker passing through the grates or clinker-grinder are collected by the inclined bottom 34 (which may be conveniently formed by a filling of cement) into a trough 35, fitted with a worm-screw 36. The trough 35 terminates at one end in an ash-pit 37, from which the ashes may readily be removed. The interior of the furnace is sealed against the escape of air through the ash-pit by means of the plate 38, which projects downwardly beneath the surface of the water which is kept supplied in the ash-pit.

As will be seen upon reference to Figs. 1 and 2, chambers 39 are provided at the ends of the furnace by the supporting-plates 40, which likewise afford convenient mounting for the shafts 28. At one end I provide an inlet 41 for air or a mixture of air and steam to support the combustion, while opposite said inlet within the chamber 39 is a deflector 42 to divide the current of air and cause it to pass equally in opposite directions through flues 43 into the spaces beneath the fire-pot. The flues 43 are preferably lined by plates 44.

A furnace as above described is especially adapted for economically handling waste coal

or coal in very finely-divided condition and causing complete combustion of the same without material waste.

The furnace illustrated is designed more particularly for the production of gas, which is driven off from the material and caused to escape through an opening 45 beneath the arch; but it is obvious that the features of my invention may be embodied with equal advantage in furnaces constructed for other purposes.

I am aware that it has been proposed to construct a grate of reciprocating or oscillating bars having substantially-horizontal supporting ends which when reciprocated from horizontal position downward are intended to cause the ashes and fuel to feed downwardly; but experience has demonstrated that the fine light ashes from fine fuel will not move under the influence of these grate-bars, but will accumulate about them and hold back the clinker, while allowing unconsumed heavier fuel to go to the bottom and be discharged. By my construction I insure proper action of the ashes and fuel by cutting out or raking off the fine ashes by means of the upward oscillation of the plates and cause said ashes to discharge through the openings between the plates. The clinker is then left under full control of the grate bars or plates and by the return movement of the latter is forced downward without unduly disturbing the unconsumed fuel.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a furnace, the combination of a grate made up of a downwardly-inclined series of trunnioned or pivoted bars projecting one beyond another inwardly toward the fire and normally presenting approximately-horizontal portions for affording vertical support to the fuel, and means for rocking said bars in a direction to move their inner edges from said normal toward a vertical position, whereby adjacent material is raked upward.

2. In a furnace, the combination of a grate composed of a downwardly-inclined series of pivoted or trunnioned bars projecting one beyond the other inwardly toward the fire, normally presenting approximately-horizontal portions affording vertical support for the fuel, provided with enlargements along their protruding inner edges which rake in the ashes when the bars are oscillated, and suitable means for oscillating the bars in a direction to cause their said inner enlarged edges to rake upward from horizontal toward vertical position.

3. In a furnace, a grate made up of a number of trunnioned bars projecting one beyond another in downwardly-inclined series, suitably spaced apart for the passage of air between them, formed with enlargements upon their inner edges next the fire, which close the spaces between them when they are oscillated in a direction to move said enlarge-

ments upward toward vertical position, and having suitable means for oscillating them in unison in such direction.

4. In a furnace, a grate made up of a number of trunnioned bars projecting one beyond the other in a downwardly-inclined series affording vertical support to the fuel resting upon them, spaced apart for the passage of air between them and permitting the escape of ashes between them when rocked in a direction to move their edges next the fire upward toward vertical position, and having enlargements along their inner ends for closing the passages between them against the escape of fuel when they are moved toward vertical position; said enlargements being toothed or serrated to avoid cutting off the supply of air; substantially as herein set forth.

5. In a furnace, the combination of the downwardly-inclined series of substantially-horizontal grate-bars suitably trunnioned, a bar connecting said grate-bars in series, and means for imparting movement to the connecting-bar to oscillate the grate-bars from horizontal toward vertical position, and causing them to rake the adjacent fine ashes into the discharging-spaces between them; substantially as herein set forth.

6. In a furnace, the combination of the knees or supports 18 formed with the vertical portions 18^a and inclined portions 18^b in conformity with the vertical section of the firepot, two series of grate-bars trunnioned in the inclined portions of said knees and spaced apart to permit them to assume an approximately-horizontal position and to be moved toward a vertical position, a clinker-crusher located at the angles of the knees, and means for oscillating said grate-bars at will; substantially as set forth.

7. A normally-horizontal oscillating grate-bar having a flat fire-supporting portion and an upwardly-raking enlargement along its edge distant from the trunnions.

8. The herein-described grate-bar 19 having trunnions 20 at its respective ends, formed with a longitudinal enlargement 21 along the edge next the fire, and with projections 22 upon its other edge for attachment of means for oscillating it; substantially as set forth.

9. The herein-described normally-horizontal flat grate-bar 19 constructed with trunnions 20 at its respective ends, and with an enlargement 21 along its inner edge distant from the trunnions, serrated or toothed, substantially as shown.

10. In a furnace, a series of overlapping pivoted grate-plates having normally-horizontal flat supporting portions, and presenting normally a continuous support for fine fuel without vertical passage through the grate, and means for moving the horizontal portions of said plates from horizontal to vertical position; whereby they open vertical passages between them and rake thereinto the adjacent fine ashes; substantially as set forth.

11. In a furnace, the combination of the

trunnioned grate-bars spaced apart for the escape of ashes between them when moved toward vertical position, and having means for oscillating them to cause them to feed downward clinker or other products of combustion too large to pass between them, and the clinker grinder and discharger located at the bottom of the fire-pot formed by said grates; substantially as herein explained.

10 12. In a furnace-grate, a plurality of overlapping pivoted grate-bars, or plates, suitably spaced apart, provided with normally-horizontal flat supporting portions, affording sup-

port for fine fuel without vertical passage through the grate and with raking enlargements or flanges along their edges distant from their trunnions, and means for moving the horizontal portions of said bars or plates from horizontal position upward toward vertical position to open vertical passages between the bars or plates and rake into said passages ashes adjacent thereto. 15 20

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