March 31, 1964 H. L. WAGNER 3,126,846

INCINEARATOR GRATE

Filed April 7, 1960 4 Sheets-Sheet 1

Fig. 1.

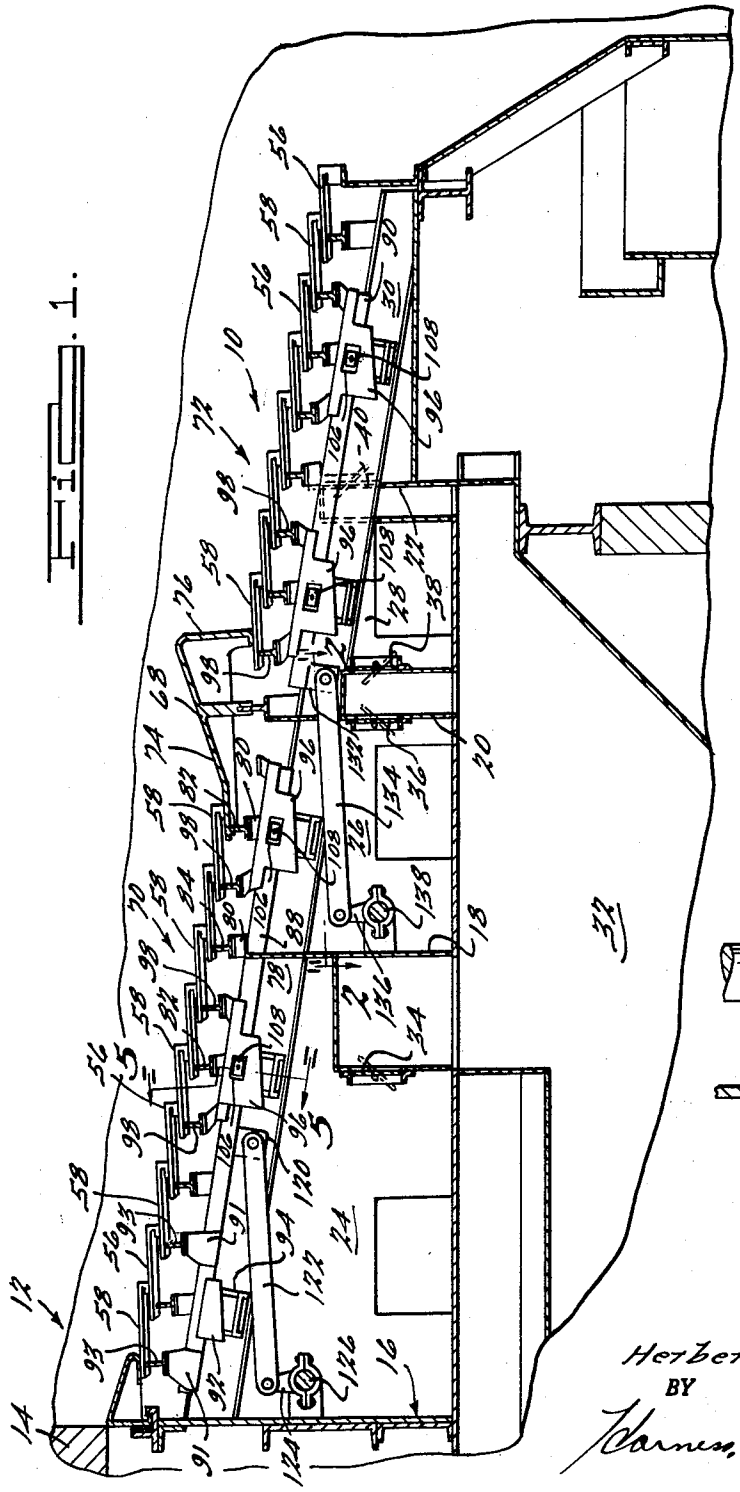
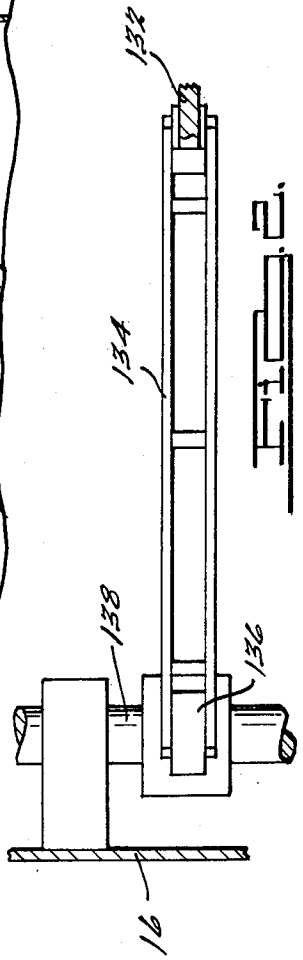


Fig. 2.



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INCINEARATOR GRATE

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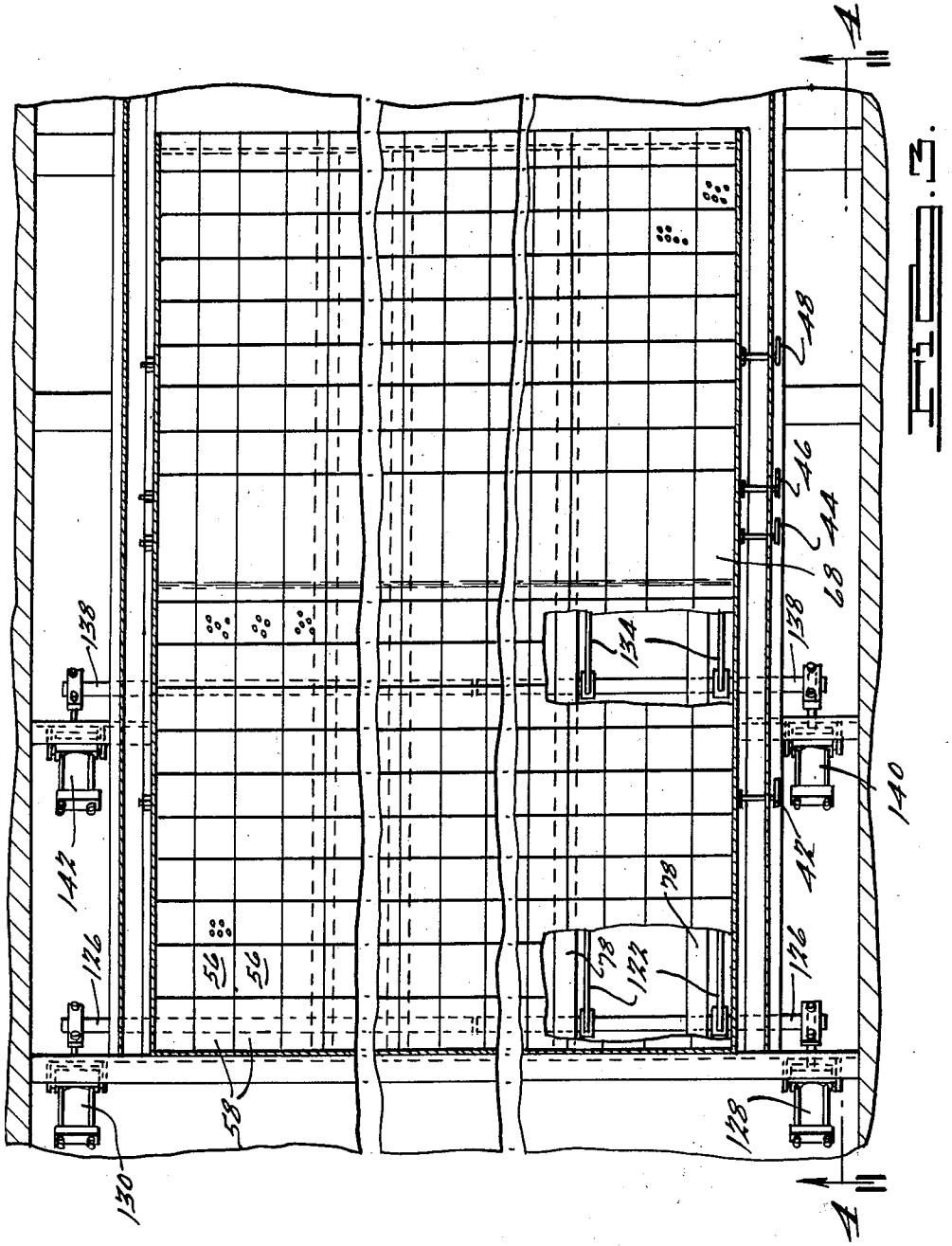


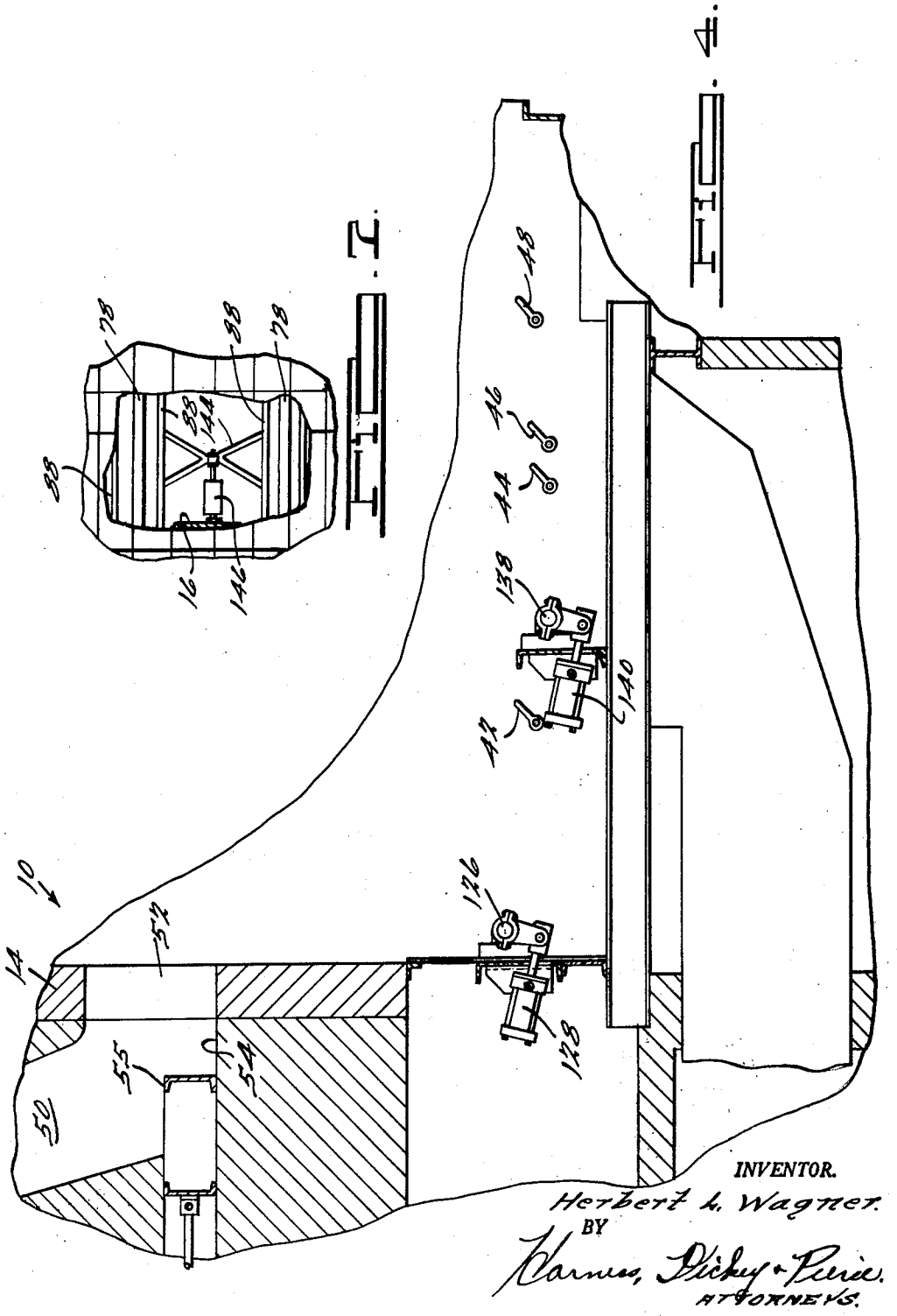
Fig. 3.

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INCINEARATOR GRATE

Filed April 7, 1960 4 Sheets-Sheet 4

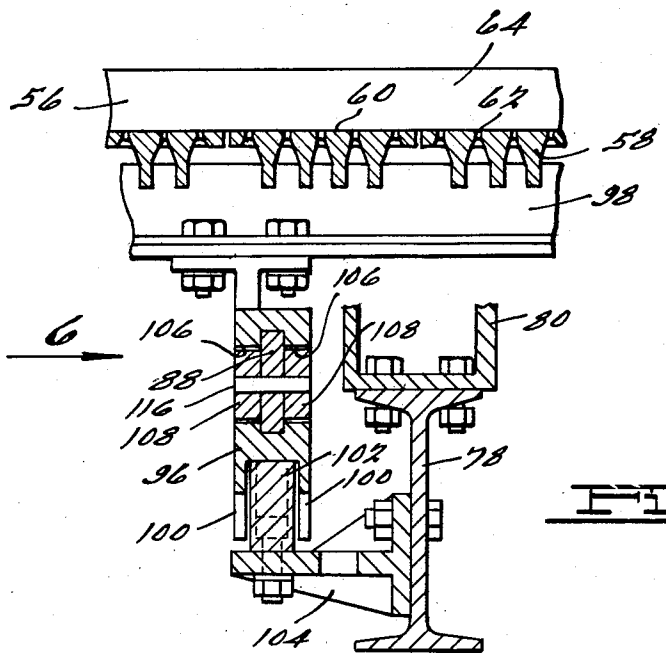


FIG. 5.

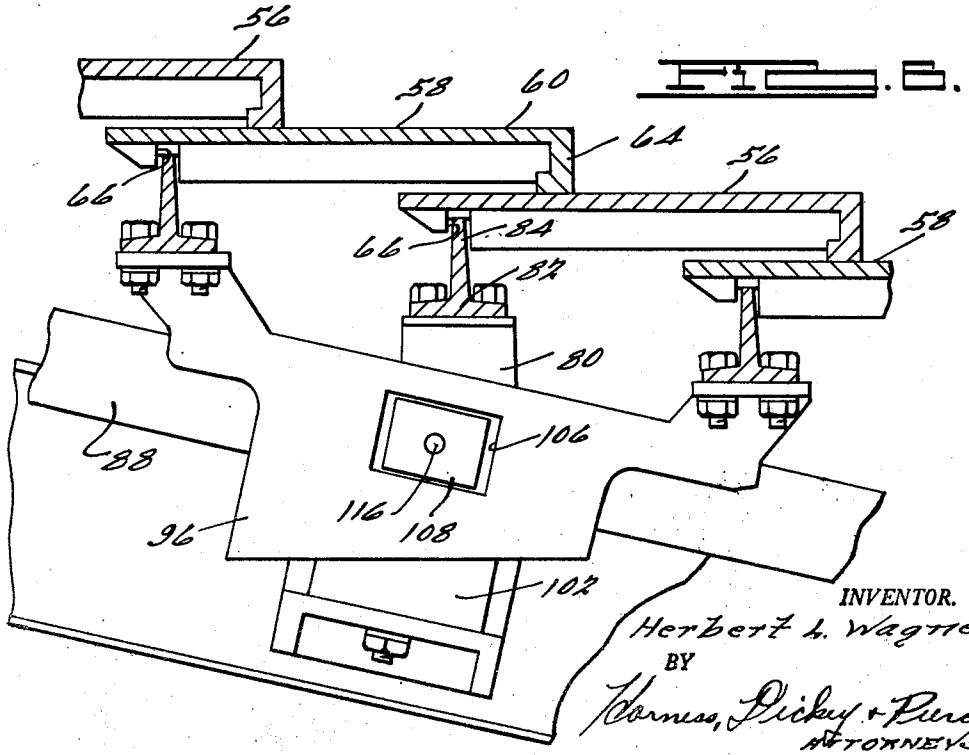


FIG. 6.

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3,126,846

INCINERATOR GRATE

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8 Claims. (Cl. 110—38)

This invention relates generally to furnace grates and more particularly to an improved incinerator grate.

Municipal and industrial refuse varies widely in bulk, density, moisture and combustible matter. A very high percentage of the fuel value in most refuse is in a volatile state and, therefore, burns rapidly. However, some of the refuse is in the form of books, bundles of paper tied together by wire or the like, masses of green grass clippings, and other compacted masses which will not burn readily. This wide variation in the combustibility of the refuse fed to an incinerator has heretofore made it difficult to dispose of the refuse in an efficient manner due to the inability to maintain a fuel bed of uniform density without any holes in the fuel bed. The principal object of this invention, therefore, is to provide an improved incinerator grate which is operable to provide for an efficient disposal of refuse of all kinds. Rapid and violent agitation as well as substantial conveyor action is provided over the end portion of the grate onto which the refuse is initially fed, refuse masses which have not burned on this portion of the grate are broken up, and a gradual reduction of the conveyor action on the refuse is effected as the refuse which is not initially consumed proceeds toward the opposite end of the grate. The gradual reduction in the conveyor action applied to the refuse compensates for the reduction in mass or bulk of the refuse due to gradual decomposition of the refuse as it proceeds toward the opposite end of the grate. As a result, a fuel bed of practically uniform thickness, density and porosity, irrespective of the variable burning characteristics of the refuse, is maintained on the grate without any manual attention to the refuse.

A further object of this invention is to provide an incinerator grate of conveyor type with a stationary intermediate section which functions to retard the travel of the refuse to thereby compress the faster-burning refuse and provide for more efficient burning thereof, and in addition, provides for a breaking up of masses of refuse traveling off the stationary intermediate grate section onto the next conveyor section of the grate.

Another object of this invention is to provide an incinerator grate assembly which is formed of a plurality of side by side and end to end reciprocating conveyor grate sections, each of which includes its own power means for effecting reciprocation, so that the rate of travel of the refuse on the various grate sections is separately adjustable to adjust the conditions for burning to the character of the refuse thereon.

Still another object of this invention is to provide an incinerator grate, of the type which includes overlapping grate members alternate ones of which are reciprocatable to effect a conveyor action on the refuse disposed on the grate, which is provided with improved adjustable structure for determining the rate of travel of refuse on the grate.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims and the accompanying drawing in which:

FIGURE 1 is a fragmentary vertical sectional view of an incinerator equipped with the improved grate assembly of this invention;

FIGURE 2 is an enlarged sectional view of a reciprocatable draw bar in the grate assembly of this invention, looking substantially along the line 2—2 in FIG. 1;

FIGURE 3 is a foreshortened plan view of the incinerator grate of this invention;

FIGURE 4 is a fragmentary sectional view of the incinerator looking along the line 4—4 in FIG. 3;

FIGURE 5 is an enlarged transverse sectional view of the grate assembly of this invention looking substantially along the line 5—5 in FIG. 1;

FIGURE 6 is an elevational view of the structure shown in FIG. 5 looking in the direction of the arrow indicated at 6; and

FIGURE 7 is a plan view of an assembly of the grate reciprocating draw bars and the actuating cylinder therefor in a modified form of the grate assembly of this invention.

With reference to the drawing, the grate assembly of this invention, indicated generally at 10, is illustrated in FIG. 1 in an incinerator 12 of a type for burning industrial and municipal refuse. The incinerator 12 includes a front wall 14 and a main frame 16, which supports the grate assembly 10 and a plurality of partition walls 18, 20 and 22 disposed below and extending transversely of the grate assembly 10. The partitions 18, 20 and 22 divide the space below the grate into four chambers 24, 26, 28 and 30, which are spaced longitudinally of the grate and which communicate with a forced air supply duct 32 disposed below the main frame 16. Dampers 34, 36, 38 and 40 control the amount of air supplied to the chambers 24, 26, 28 and 30, respectively, from the supply duct 32 and the positions of the dampers 34, 36, 38 and 40 are controlled by levers 42, 44, 46 and 48 disposed on one side of the incinerator 12 and connected to the dampers. The dampers are adjusted to control the amount of air for combustion supplied to the various sections of the grate assembly 10 to control the burning conditions of the refuse on these sections of the grate.

Refuse is fed to the incinerator through a chute 50 (FIG. 4), which terminates at its lower end at an opening 52 in the front wall 14 of the incinerator 10. The chute can be filled either manually or by mechanical means such as a conveyor, overhead crane, bulldozer, or the like, with refuse to be burned in the incinerator 12. The refuse slides down the chute 50 onto a horizontal surface 54 and is pushed through the opening 52 by a ram or pusher unit 55 so that it falls onto the section of the grate 10 adjacent the front wall 14.

The grate assembly 10 is formed of a plurality of overlapping substantially horizontal grate members 56 and 58 which are alternately arranged. Alternate grate members 56 are stationary and movable grate members 58 are provided between each adjacent pair of stationary members 56. The front ends of the movable grate members 58 overlap the rear or back ends of the stationary grate members 56 while the front ends of the stationary members 56 overlap the rear or back ends of the movable grate members 58. The movable grate members 58 are reciprocatable relative to the stationary members 56, as will clearly appear hereinafter, and reciprocate from front to rear relative to the incinerator or from left to right as viewed in FIG. 1, so as to move refuse thereon from left to right.

Each of the grate members 56 and 58 has a flat upper surface 60 and is formed with vertically extending air supply openings 62. One end of each of the grate members 56 and 58 is formed with a downturned inwardly directed flange 64 and the opposite end of each grate member is formed on its underside with a groove or notch 66 for a purpose to appear presently. As shown in FIG. 5, the stationary grate members 56 are arranged side by side in rows extending transversely of the grate assembly 10. The movable grate members 58 are similarly arranged side

by side so that they form rows also extending transversely of the grate assembly 10. If desired, the adjacent edges of adjacent grate members may be separated by filler bars (not shown) of suitable shape to prevent ash from seeping down or dropping through the space between adjacent grate members. One form of a filler bar suitable for this purpose is shown in my prior Patent No. 2,606,439.

As best appears in FIG. 1, the grate members 56 and 58 are arranged in a stepped formation extending from front to rear of the incinerator 12, with the steps leading downwardly from the portion of the grate assembly 10 immediately below the refuse supply opening 52. The grate members 56 and 58 adjacent the front wall 14 of the incinerator 12 are separated by a stationary grate section 68 from the grate members 56 and 58 which are adjacent the opposite wall of the incinerator. The stationary grate section 68 thus functions to divide the grate members 56 and 58 into two groups, a first group which is above the grate section 68 is designated by the numeral 70 and constitutes an upper grate section. Another group of grate members 56 and 58 is disposed below the stationary grate section 68 and is designated generally by the numeral 72. The stationary grate section 68 has a first portion 74 which inclines upwardly from the lower end of the section 70 and a second vertical portion 76 which is disposed above a movable grate member 58 in the grate section 72 for a purpose to appear presently.

The grate members 56 and 58 are supported on a plurality of I-beams 78 which extend longitudinally of the grate assembly 10 and are inclined downwardly and rearwardly away from the incinerator front wall 14. The I-beams 78, which are rigidly mounted on the main frame 16, are spaced apart in a direction transversely of the incinerator grate assembly 10 and each I-beam 78 carries on its top side a plurality of box shape bracket members 80 which are spaced apart in a direction longitudinally of the I-beam 78, as shown in FIG. 1. The box brackets 80 on adjacent I-beams 78 are aligned in a direction transversely of the grate assembly 10 so that they form supports for stationary inverted T-bars 82 which are secured to the brackets 80 and extend transversely of the grate assembly 10. The upwardly extending leg 84 in each T-bar 82 projects into the groove 66 adjacent one edge of each stationary grate member 56 in a row of grate members 56.

A plurality of draw bars 88 and 90 are arranged in pairs alongside and in a substantially parallel relation with the I-beams 78 with each draw bar 88 being disposed below the upper grate section 70 and each draw bar 90 being disposed below the lower grate section 72. Each draw bar 88 is slidably supported adjacent one end in a saddle 92 mounted on a bracket 94 carried by the adjacent I-beam 78. Adjacent its upper end each draw bar 88 has a pair of brackets 91 fixed thereon at longitudinally spaced positions and inverted T-bars 93 are mounted on the brackets 91 so that the bars 93 extend transversely of the grate assembly 10 and project into the grooves 66 in the upper two rows of grate members 58.

Intermediate its ends, the draw bar 88 extends through a first hollow carrier member 96 which is disposed below a stationary T-bar 82 and carries a pair of spaced inverted T-bars 98 which project into the grooves 66 in a pair of rows of movable grate members 58 disposed on opposite sides of the stationary T-bar 82. The carrier 96 (FIGS. 5 and 6) has a pair of depending legs 100 which are disposed on opposite sides of a guide block 102 which projects upwardly from and is carried by a bracket 104 secured to one side of the adjacent I-beam 78. The carrier 96 is formed with a pair of openings 106 which are disposed on opposite sides of the draw bar 88 and are in horizontal alignment with the draw bar 88. A pair of drive blocks 108 are disposed in the openings 106 and are carried on a mounting pin 116 secured to the draw bar 88. The dimensions of the drive blocks 108 in a direction parallel to the direction of reciprocation of the draw bar 88 relative to the dimension of the opening 106 in this direction determines the amount of lost motion between the draw bar 88 and the carrier 96. A plurality of sets of drive blocks 108 having different dimensions in the direction of reciprocation are provided so that the amount of lost motion can be adjusted to provide the desired movement of the grate members 58 by selecting the appropriate set of blocks 108. A second carrier 96 is assembled with the draw bar 88 adjacent the lower end thereof and this carrier 96 carries a T-bar 98 which is engaged with the row of movable grate members 58 which overlap the stationary intermediate grate section 68.

The draw bar 90 is provided adjacent its upper end with a third carrier 96 which carries a pair of movable T-bars 98, the upper one of which is engaged with a row of movable grate members 58 which are disposed underneath the portion 76 of the stationary intermediate grate section 68. At its lower end the draw bar 90 is provided with a fourth carrier 96 which actuates a pair of rows of movable grate members 58, the lower one of which overlaps the lowest stationary row of grate members 56. All of the carriers 96 are provided with a plurality of sets of drive blocks 108 which are usable interchangeably to adjust the lost motion between the draw bars 88 and 90 and the carriers 96 to provide the desired reciprocating strokes for the movable grate members 58 at the different grate sections, and thereby regulate the burning conditions at the various grate sections to obtain the best results. The brackets 91 and the carriers 96 on the draw bars 88 and 90 are aligned transversely of the grate 10 so that the T-bars 93 and 98 are parallel to the T-bars 82.

The number of draw bars 88 and 90 required in the incinerator grate assembly 10 is dependent on the width of the assembly 10; the wider the grate assembly, the more draw bars required to move the larger number of movable grate members 58. Each of the draw bars 88 is provided intermediate its ends with a downwardly projecting ear 120 which is connected to one end of an actuating link unit 122 which is attached at its opposite end to a rocker arm 124 carried by a drive or rock shaft 126 journaled on the main frame 16. In the form of the invention illustrated in FIG. 3, the drive shaft 126 is split intermediate its ends and one end of the shaft is connected to a hydraulic cylinder assembly 128 and the opposite end is connected to another hydraulic cylinder assembly 130. The cylinder assemblies 128 and 130 are mounted on the main frame 16 so that when the piston rods therefor are extended and retracted the shaft 126 is rocked back and forth to reciprocate the draw bar links 122 and in turn reciprocate the draw bars 128. Since the shaft 126 is split intermediate its ends, the portion of the upper section 70 of the grate assembly 10 which is connected to the hydraulic cylinder assembly 128 can be reciprocated at a rate different than the rate of reciprocation of the portion of the section 70 which is driven by the hydraulic cylinder assembly 130.

At its upper end, each of the draw bars 90 carries a downwardly extending ear 132 which is attached to one end of a draw bar link unit 134 connected at its opposite end to a rocker arm 136 secured to a drive or rock shaft 138 journaled on the partition 18 which forms a part of the main frame 16. The rock shaft 138 is likewise split intermediate its ends with one end being drivingly connected to a hydraulic cylinder assembly 140 and the other end to a hydraulic cylinder assembly 142 both of which are mounted on the main frame 16 and are operable to rock the corresponding sections of the rock shaft 138 to in turn reciprocate the draw bars 90.

In the modified form of the draw bar actuation mechanism shown in FIG. 7, each pair of adjacent draw bars 88 is connected to the upper ends of a wishbone shape frame unit 144 which is drivingly connected at its lower end to a hydraulic cylinder unit 146 so that when the unit 146 is extended and retracted, the draw bars 88 are reciprocated. It is contemplated that a similar wishbone shape frame unit 144 will be provided for each pair of

draw bars 90 corresponding to a pair of draw bars 88. The advantage of this arrangement is that the grate assembly 10 can be formed in preassembled units, each of which includes a pair of draw bars 88 and a pair of draw bars 90, and as many of these units as are necessary to provide an incinerator of the required capacity can be assembled side by side, and with a stationary grate member 68 in between the sections 70 and 72, to form the assembly 10.

In the use of the grate assembly 10, refuse is delivered through the opening 52 to the top end of the upper grate section 70. Much of this refuse is highly combustible and will therefore burn very rapidly. For this purpose, the hydraulic cylinder assemblies 128 and 130 are set to reciprocate the movable grate members 58 in the grate section 70 very rapidly and the damper 34 is adjusted to provide for a large supply of combustion air to the portion of the grate section 70 above the chamber 24. The arrangement of the two drive cylinders 128 and 130 makes it possible to agitate one portion of the upper end of the grate assembly 10 faster than the adjacent portion so that different types of refuse can be fed to these portions of the grate when this is a practical mode of operation of the incinerator 12. The upper end of the grate section 70 is agitated most violently since it receives the raw refuse. For this reason, no means is provided for adjusting the degree of agitation of this section of the grate, other than to adjust the cylinder assemblies 128 and 130. The portion of the grate assembly 10 immediately therebelow is reciprocated by the uppermost carrier 96. The drive blocks 106 for this carrier are selected to provide for a slight amount of lost motion between the draw bar 88 and this carrier 96. Consequently, the stroke of the grate members 58 in this portion of the grate assembly 10 is reduced so that the conveyor action on the refuse is reduced.

As each of the grate members 58 is moved toward the wall 14, in response to counterclockwise rotation of the rack shaft 124, as viewed in FIG. 1, the refuse on the members 58 is moved toward the end 64 thereof by the stationary members 56. Some of this refuse on the members 58 is pushed off onto the adjacent lower stationary member 56. When the rack shaft 124 rotates clockwise (FIG. 1) the members 58 are moved away from the wall 14 to push refuse on the stationary members 56 toward the ends 64 thereof with some refuse being moved off the members 56 onto the adjacent lower members 58, to thus accomplish the refuse conveying action. The members 58 are never reciprocated far enough to leave any gap between them and the adjacent rows of members 56 for each row of members is supported at the ends 64 of the members on the adjacent lower row.

The less combustible portion of the refuse which has not burned initially and reaches the intermediate portion of grate section 70 is moved at a slower rate so that the burning thereof can continue at a slower rate as it travels downwardly from the top surface of one row of grate members onto the next and onto the movable grate members 58 controlled by the carriers 96 on the lower ends of the draw bars 88. These carriers can be adjusted, by selection of the drive blocks 108 therefor so that the desired lost motion is provided between the draw bars 88 and the carriers 96 to further reduce the conveyor action of the grate section 70 adjacent the lower end thereof.

The stationary grate section 68 has the portion 74 thereof inclined upwardly so that refuse delivered to the stationary grate section 68 from the lower end of the upper section 70 must be pushed up the incline of the portion 74. This pushing action on the refuse acts to compress the fuel bed which is forwardly of or above the grate section 68 which provides for more efficient burning of the combustible matter in this fuel bed. The compression of this partially burned refuse also increases the fuel bed temperature so as to help ignite and burn some of the items in the fuel bed. The compressed refuse on

the portion 74 of the stationary grate section 68 is pushed off the end thereof so that it tumbles onto the upper end of the lower grate section 72. The refuse which is difficult to burn, namely, the bundles of paper, books, green grass clippings, and so on, have been thoroughly dried by the time they are tumbled onto the lower grate section 72 so that they ignite on this grate section and burn efficiently and are decomposed into clean ash.

The hydraulic cylinder assemblies 138 and 140 which reciprocate the lower draw bars 90 are adjusted so that these draw bars reciprocate at a slower speed than the draw bars 88. Likewise, the drive blocks 108 for the carriers 96 on the draw bars 90 are of a size such that the stroke of each of the grate members 58 in the grate section 72 is reduced. In one embodiment of the invention, the stroke of the grate members 58 can be varied between one inch and six inches. Consequently, the difficult-to-burn refuse which is on the lower grate section 72 is subjected to a reduced conveying action so that this refuse can burn efficiently at a slower rate. Likewise, the supply of air to the lower air chambers 26, 28 and 30 is reduced by adjustment of the dampers 36, 38 and 40 so that burning takes place at a slow rate on the grate sections which receive air from these chambers. In any given installation, however, the drive blocks 108 on the draw bars 90 can be adjusted to provide increased agitation and the amount of rotation of the shaft 138 can be increased by adjustment of the cylinders 140 and 142 if desired to provide particular burning conditions.

The reciprocating action of the lower grate section 72 continues to convey the fuel bed toward the discharge point at the rear end of the grate. Ash residue, tramp iron, inert material, and tin cans, are discharged off the lowermost row of stationary grate members 56 onto a suitable ash discharge mechanism (not shown.)

From the above description, it is seen that this invention provides a versatile incinerator grate assembly 10 which includes a plurality of rows of alternately arranged stationary and movable grate members 56 and 58 which can be relatively reciprocated to provide the necessary refuse agitation and conveying action at the various portions of the grate to maintain a fuel bed of practically uniform thickness and density over the entire length of the grate irrespective of the variable burning characteristics of the material being burned to thereby make it possible to use the incinerator 12 at full capacity at all times.

It will be understood that the specific construction of the improved incinerator grate assembly which is herein disclosed and described is presented for purposes of explanation and illustration and is not intended to indicate limits of the invention, the scope of which is defined by the following claims.

What is claimed is:

1. In a grate assembly, a plurality of alternate stationary and movable grate members arranged in a stepped formation, a supporting frame disposed below said grate members, stationary support members on said frame for said stationary grate members, a carrier member for a plurality of said movable grate members guidably mounted on said frame for reciprocating movement, means connecting said carrier member to said movable grate members, a reciprocatable draw bar mounted adjacent said carrier, lost motion means connecting said draw bar and said carrier to provide for reciprocation of said carrier in response to reciprocation of said drawbar, and means for reciprocating said draw bar.

2. In a grate assembly, a plurality of alternate stationary and movable grate members arranged in a stepped formation, a supporting frame disposed below said grate members, stationary support members on said frame for said stationary grate members, a carrier member for a plurality of said movable grate members guidably mounted on said frame for reciprocating movement, means connecting said carrier member to said movable grate members, a reciprocable draw bar mounted adjacent said car-

rier, drive block means on said draw bar engageable with portions of said carrier spaced in the direction of reciprocation of said draw bar and on reciprocation of said draw bar predetermined distances in opposite direction to provide for concurrent movement of the carrier and the draw bar during a selectably variable portion of each reciprocation of the draw bar, and means for reciprocating said draw bar.

3. In a grate assembly, a plurality of alternate stationary and movable grate members arranged in a stepped formation, a supporting frame disposed below said grate members, stationary support members on said frame for said stationary grate members, a carrier body for a plurality of said movable grate members guidably mounted on said frame for reciprocating movement, means connecting said carrier body to said movable grate members, a reciprocatable draw bar body, said carrier body being loosely mounted on said draw bar body, lost motion means connecting said draw bar and said carrier to provide for reciprocation of said carrier in response to reciprocation of said draw bar, said lost motion means including means providing an opening in one of said bodies and drive block means on the other one of said bodies, said drive block means being of a selectably variable dimension in the direction of reciprocation of said draw bar less than the dimension of said opening in said direction, and means for reciprocating said draw bar.

4. In an incinerator, a grate assembly comprising a plurality of side by side grate units each of which includes an upper conveyor section having an input end onto which refuse to be burned is deposited, an intermediate stationary section which receives partly burned refuse from said upper section, and a lower conveyor section arranged for receiving partly burned refuse from said stationary section and for transferring the burned refuse toward and discharging it from the outlet end thereof, said upper section and said lower section disposed in a downwardly inclined relationship from said input end toward said outlet end, said intermediate section having an upwardly inclined stationary portion projecting above the plane of said upper section for retarding the travel of refuse downwardly along said upper section and terminating above said lower section to provide for tumbling of refuse from said intermediate section to said lower section, each of said upper and lower sections being formed of a plurality of alternate stationary and movable grate members arranged in a stepped formation between the front and rear ends of said section, a supporting frame disposed below each of said units, stationary support means on said frame for said stationary grate members, means including a plurality of side by side reciprocatable draw bars on said frame for reciprocating the movable grate members in each section relative to the stationary grate members therein, and separate means for the draw bars in each section for reciprocating said draw bars, whereby the frequency and length of reciprocation of the movable grate members in each section is regulatable separately from any other section.

5. In an incinerator, a grate assembly comprising a plurality of side by side grate units each of which includes an upper conveyor section having an input end onto which refuse to be burned is deposited, an intermediate stationary section which receives partly burned refuse from said upper section, and a lower conveyor section arranged for receiving partly burned refuse from said stationary section and for transferring the burned refuse toward and discharging it from the outlet end thereof, said upper section and said lower section disposed in a downwardly inclined relationship from said input end toward said outlet end, said intermediate section having an upwardly inclined stationary portion projecting above the plane of said upper section for retarding the travel of refuse downwardly along said upper section and terminating above said lower section to provide for tumbling of refuse from said intermediate section to said lower section, each of said upper and lower sections being formed of a plurality of alternate stationary and movable grate members arranged in a stepped formation between the front and rear ends of said section, each of said grate members being perforated, a supporting frame disposed below each of said units, stationary support means on said frame for said stationary grate members, means including a plurality of side by side reciprocatable draw bars on said frame for reciprocating the movable grate members in each section relative to the stationary grate members therein, means for supplying air for combustion to the lower sides of the grate members in said sections, means for separately regulating the supply of air to said sections, and separate means for the draw bars in each section for reciprocating said draw bars, whereby the frequency and length of reciprocation of the movable grate members in each section is regulatable separately from any other section.

6. In an incinerator having a front end and a rear end, a grate assembly comprising a plurality of side by side grate units each of which includes an upper section having an input end onto which refuse to be burned is deposited, an intermediate stationary section which receives partly burned refuse from said upper section, and a lower section arranged for receiving partly burned refuse from said stationary section and for transferring the burned refuse toward and discharging it from the outlet end thereof, said upper section and said lower section disposed in a downwardly inclined relationship from said input end toward said outlet end, said intermediate section having an upwardly inclined stationary portion projecting above the plane of said upper section for retarding the travel of refuse downwardly along said upper section and terminating above said lower section to provide for tumbling of refuse from said intermediate section to said lower section, each of said upper and lower sections being formed of a plurality of alternate rows of stationary and movable grate members arranged in a stepped formation between the front and rear ends of said section, a supporting frame disposed below each of said units, stationary support means on said frame for said stationary grate members, means including a pair of side by side reciprocable draw bars for reciprocating the movable grate members in each section relative to the stationary grate members therein, and separate means for the draw bars in each section for reciprocating said draw bars, whereby the frequency and length of reciprocation of the movable grate members in each section is regulatable separately from any other section, said reciprocating means comprising a frame connecting the draw bars in each section, and means for moving said frame so as to reciprocate the draw bars connected thereto.

7. In an incinerator a grate assembly comprising a plurality of side by side grate units each of which includes an upper conveyor section having an input end onto which refuse to be burned is deposited, an intermediate stationary section which receives partly burned refuse from said upper section, and a lower conveyor section arranged for receiving partly burned refuse from said stationary section and for transferring the burned refuse toward and discharging it from the outlet end thereof, said upper section and said lower section disposed in a downwardly inclined relationship from said input end toward said outlet end, said intermediate section having an upwardly inclined stationary portion projecting above the plane of said upper section for retarding the travel of refuse downwardly along said upper section and terminating above said lower section to provide for tumbling of refuse from said intermediate section to said lower section, each of said upper and lower sections being formed of a plurality of alternate stationary and movable grate members arranged in a stepped formation between the front and rear ends of said section, each of said grate members being perforated, a supporting frame disposed below each of said units, stationary support means on said frame for said stationary grate members, means including a plurality of side by side reciprocatable draw bars on said frame for recipro-

cating the movable grate members in each section relative to the stationary grate members therein, means for supplying air for combustion to the lower sides of the grate members in said sections, means for separately regulating the supply of air to said sections, and separate means for the draw bars in each section for reciprocating said draw bars, whereby the frequency and length of reciprocation of the movable grate members in each section is regulatable separately from any other section, said reciprocating means comprising a rock shaft, link means connecting said rock shaft and said draw bars, and means for alternately rotating said rock shaft in opposite directions.

8. In an incinerator, a grate assembly comprising a plurality of alternate stationary and movable grate members extending between an input end and an outlet end and arranged in a stepped formation so that said assembly has an upper section and a lower section, said upper and said lower section inclined downwardly from said input end of said upper section toward said outlet end of said lower section, each of said movable members having the end portions thereof overlapping the adjacent stationary members, means for reciprocating said movable members relative to said stationary members so that refuse on the grate assembly is conveyed from said inlet end of said upper section to said outlet end of said lower section, said grate assembly having a stationary section intermediate said upper and lower section having an upwardly inclined stationary portion for retarding the travel of refuse downwardly on said upper section of the grate assembly above the stationary section and terminating above the succeeding said lower section of the grate assembly to provide for tumbling of refuse off the stationary section onto said succeeding lower section.

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