July 21, 1953 G. PADGETT 2,646,395

CHARGING CAR

Filed April 5, 1946 3 Sheets-Sheet 1

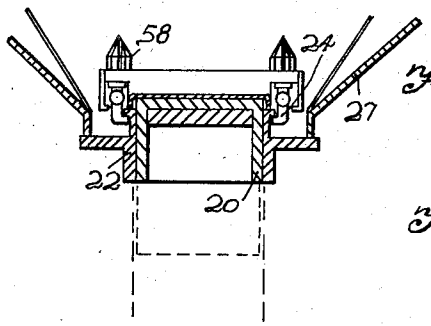
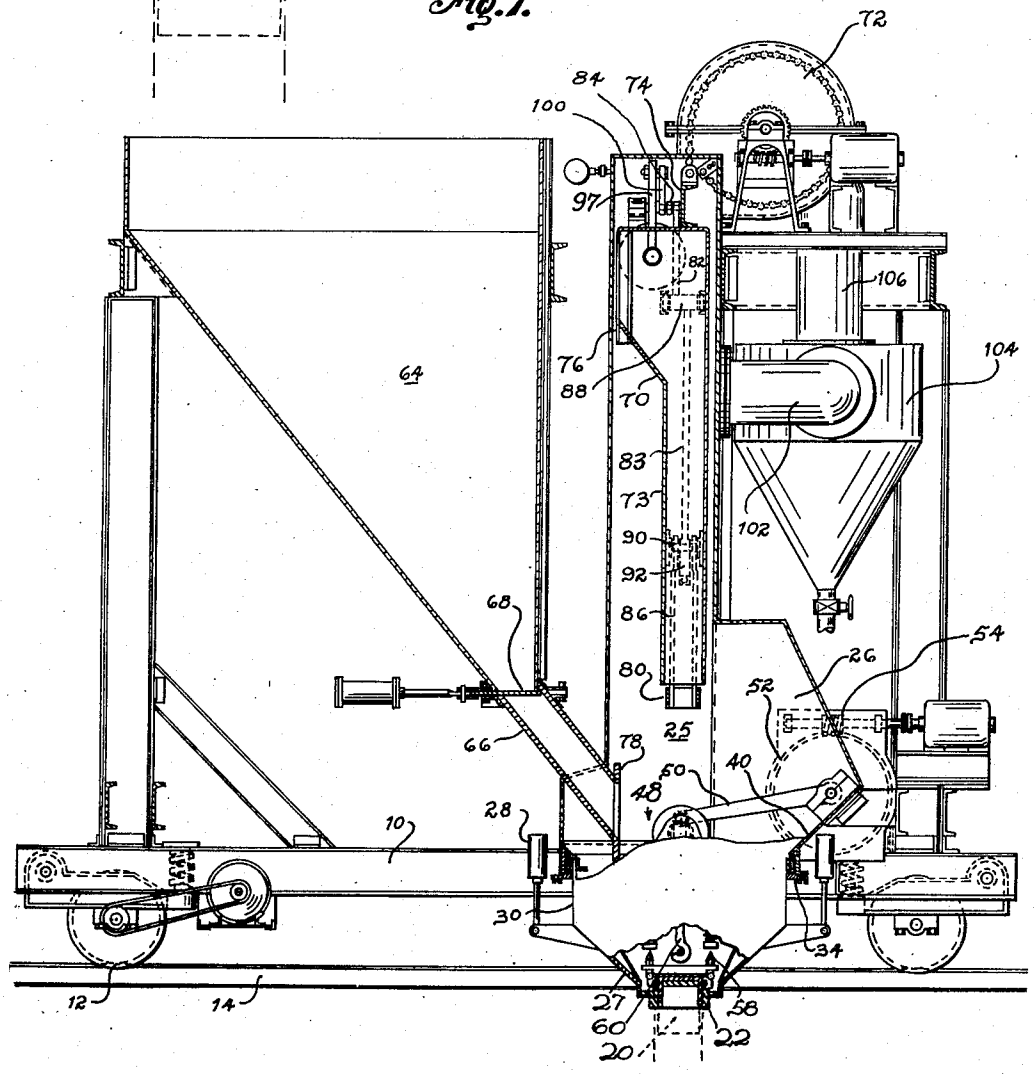


Fig. 6.

Fig. 1.



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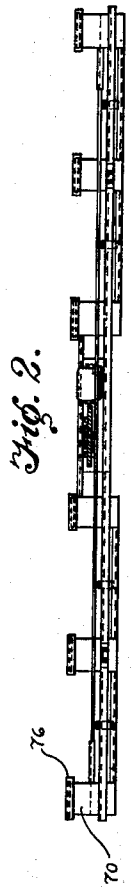


Fig. 2.

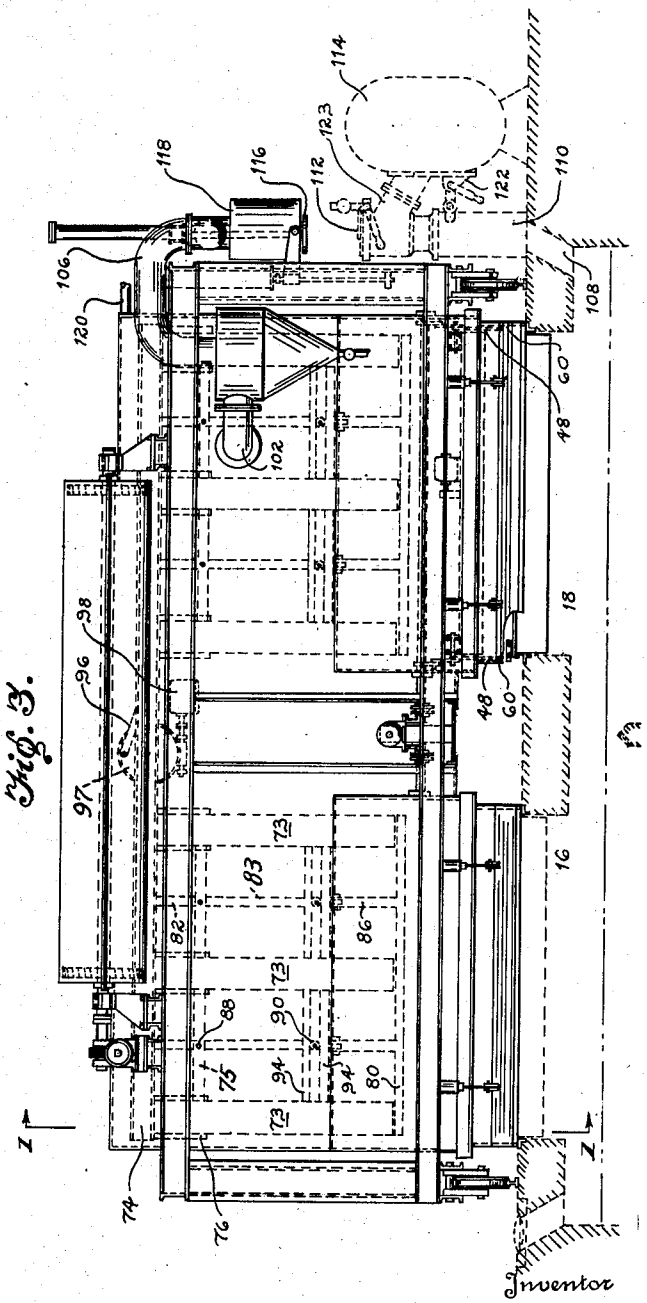


Fig. 3.

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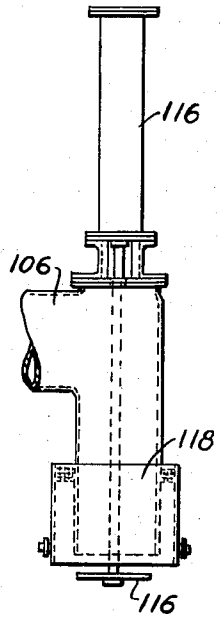
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CHARGING CAR

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Fig. 4.

Fig. 8



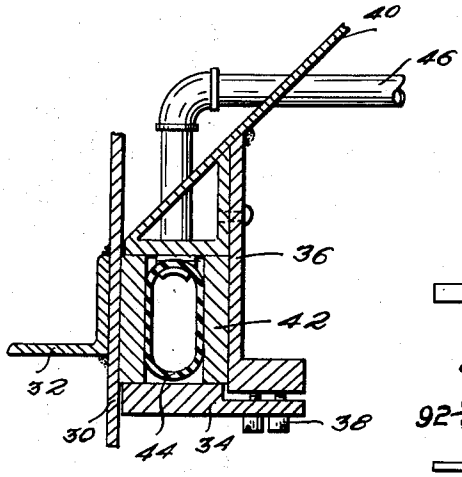


Fig. 7

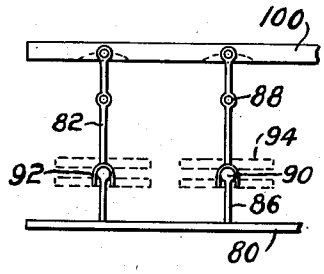
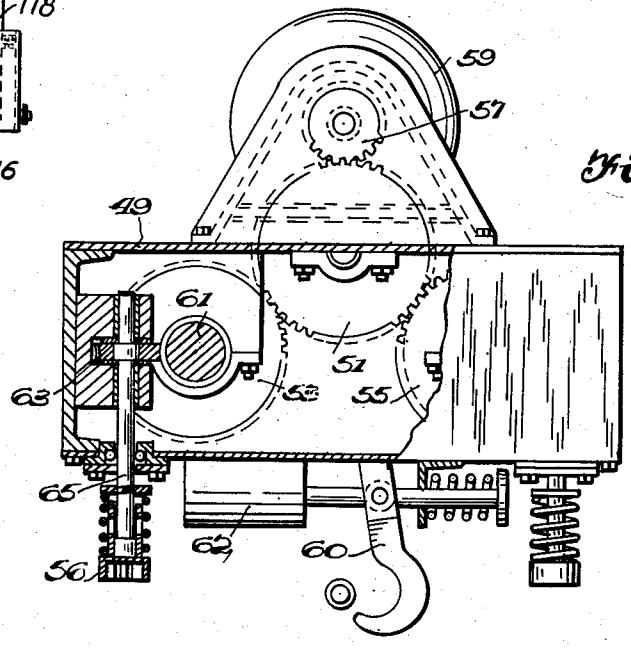


Fig. 5.



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UNITED STATES PATENT OFFICE

2,646,395

CHARGING CAR

Grady Padgett, Beaver, Pa.

Application April 5, 1946, Serial No. 659,814

11 Claims. (Cl. 202—263)

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This invention relates to charging cars particularly intended for use in conjunction with coking ovens of the vertical type wherein the charge of coal is deposited through openings in the top of the oven after removal of the top oven doors, and to a process of charging such ovens. It may be adapted for use with horizontal ovens.

It is the usual practice to charge coal into vertical chamber ovens or retorts by dumping a certain weight of coal into the coking space. Horizontal ovens are filled by charging from a car on top of the battery and leveling off to a fixed coal line by moving back and forth a long bar carried on the pusher. The coal line is determined chiefly by the elevation of the leveling door through which excess coal is drawn off by the pusher-actuated leveling bar. This operation requires the attention of two men. A constant weight of coal in the charge cannot be used because varying moisture content and degree of pulverization vary the weight per unit volume. Furthermore, large ovens vary slightly in size.

On many batteries with only one collecting main and one standpipe per oven gas is wasted to the air and dust is blown out over the plant due to the rush of gases up through the finely pulverized coal charged into the coking chamber.

On other batteries two collecting mains are provided and standpipes installed at each end of the oven. By using a steam injector in each of these standpipes and charging through one opening in the center of the oven, a partial vacuum is obtained in the oven and the gas and dust are drawn into the collecting main. Furthermore, some air which burns and results in the adldition of inerts to the gas is drawn through the charging opening and leveling door. Dust settles out partly in the decanter used to separate the tars from the liquors but a portion of this dust will remain in the tar, deteriorating its quality.

There is one other method used on batteries equipped with only one main. This comprises placing a connecting pipe from the oven being charged to the adjacent oven at the end opposite the standpipe and creating a suction in the standpipe, thus retaining the gas in the apparatus.

Among the objects of my invention are an increased economy through the labor saved by confining the operations of the charging and leveling to one machine and one operator and to speed up the charging operation, thus obtaining a still further saving in labor costs.

Other objects of the invention are to keep the dust out of the air and out of the apparatus, thus not only creating improved working conditions with all their attendant advantages but producing a better quality of tar, which is an important by-product of the coking process.

Still another object of the invention is to prevent the unnecessary admission of oxygen and inerts to the gas.

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Various other advantages and meritorious features of the invention will be apparent from the following description taken in conjunction with the drawings, wherein like numerals refer to like parts throughout the several figures and wherein:

Figure 1 is a section through 1—1 of Fig. 3;

Fig. 2 is a top plan view of the movable chute and leveling bar assembly;

Fig. 3 is an end elevation;

Fig. 4 is an enlarged sectional view of one of the details of construction;

Fig. 5 is a somewhat enlarged elevation, partially in section, of the oven door extracting and tightening mechanism;

Fig. 6 is an enlarged sectional detail view of the coupling member and oven door supporting frame shown at the bottom of Fig. 1;

Fig. 7 is a diagrammatic illustration of one end of the leveling bar, and

Fig. 8 is an enlarged detail view at right angles to Fig. 3.

The various elements of my improved charging car are supported upon a base frame 10 provided with motor-driven wheeled supports 12 movable on parallel tracks 14 which are so arranged as to permit the car to span one or more of the removable oven doors in the battery of ovens. In the embodiment illustrated the arrangement is such that the car spans two openings 16 and 18. Duplicate mechanism is provided at each side of the car for performing the various operations to be described more in detail hereafter and the car is provided with an operator's cab (not disclosed) carrying the usual controls for performing the various steps necessary to the charging operation. The duplicate mechanisms are simultaneously operable by means which will be described in detail to remove doors 20 which close the openings 16 and 18 during the coking operation and seal the ovens during that period.

The oven door construction may be of any standard type or may be of the type described and illustrated in my copending application, Ser. No. 511,618, now Patent No. 2,475,512. In any event the doors are seated on frames 22, the upper faces of which are machined, and are latched in closed position to form a gas-tight seal by means of latch mechanism broadly illustrated by the numeral 24 (Fig. 6). Extending across the width of the car centrally thereof and spanning both oven openings is a gas-tight enclosure generally designated by the numeral 25. At each end of this enclosure and spanning a single oven door is a recessed portion 26 with which is associated a coupling 27 mounted for vertical movement and actuated by some such suitable means as pneumatic cylinders 28 which

may be controlled from the operator's cab to lower the couplings after the same have been positioned over the oven doors. The free lower margins of the plates forming each movable coupling 27 cooperate with the machined upper surface of the door frame 22 to provide a gas-tight seal around each opening.

Special means are provided to assure a gas-tight seal between each movable coupling member 27 and the enclosure 25. One form of mechanism for accomplishing this end is illustrated in detail in Fig. 4 wherein vertical plates 30 of the coupling member strengthened by angle 32 slide against a sealing assembly supported upon a horizontal beam 34 and held in position adjacent plate 30 by means of a plate 36. Beam 34 is similar to a packing gland and may be adjusted vertically by nuts 38. Between sliding plate 30 of the movable coupling and plate 36 are two spaced packing blocks 42 between which is a flexible tube 44 which may be expanded by fluid pressure admitted through tube 46 to expand the inner block against plate 30 after the movable coupling has been lowered over the oven door. This arrangement insures a complete seal without the necessity for machining the sealing surfaces.

Located inside the gas-tight enclosure 25 is an oven door extracting and tightening mechanism broadly illustrated by the numeral 48 which may be raised and lowered by means of a supporting arm or lever 50 actuated by drive gear 52 which may in turn be operated by a motor-driven worm 54. Mechanism 48 (Fig. 5) embodies a housing 49 in which are journaled intermeshing gears 51, 53 and 55. These gears are actuated in one direction or another by a pinion 57 powered from an electric motor 59 controllable from the cab. Rotation of gear 51 in either direction causes rotation of worm shafts 61 which in turn rotate gears 63 to cause rotation of shafts 65, on the end of which are socket wrenches 56. Such rotation, after wrenches 56 have been lowered upon oven door bolts 58, serve by means of cam mechanism not fully illustrated herein to move cams engaging the latches 24 and release such latches to permit removal of the door. This mechanism is more completely disclosed in my copending application, Ser. No. 511,618, to which reference is made.

For removing the door, hooks 60 are adapted for movement transversely across the door to engage lifting handles. Transverse movement of each pair of hooks or door handle engaging members 60 is obtained by means of a solenoid mechanism broadly designated by the numeral 62 moving against the bias of a spring and controlled by suitable means from the operator's cam. Thus it will be seen that after the oven door has been unlatched and the hooks 60 engaged with the door handles, the arm 50 may be swung upward into the recess 26 of the gas-tight enclosure, thereby leaving the oven opening free for discharge of coal into the oven.

A main stationary hopper 64 opens into a series of spaced stationary chutes 66, each of which is provided with a gate 68 which may be pneumatically operated and controlled from the cab of the car.

A movable chute and leveling bar assembly broadly indicated by the numeral 70 is suspended within the gas-tight enclosure 25 by means of a transverse beam 74. For each oven door I have illustrated three chutes 73 which are suspended in spaced relation to one another from beam 74. There are a corresponding number of fixed chutes

66 similarly spaced and communicating with hopper 64. Guideways 76 on each side of the mouth of each of the movable chutes 73 are adapted to engage flanges 78 on each side of the mouth of each of the respective stationary chutes 66, thus positioning and aligning the movable chutes in communication with the stationary chutes when the former are lowered into operative position.

Between each adjacent pair of chutes 73 and in transverse alignment with one another is secured a member 75. A bearing pin 88 is pivotally journaled at the midsection of each of these members 75. Integral with and extending upwardly from each pin 88 is a link or arm 82 which at its upper extremity is connected by a pivot pin to reciprocating bar 100. This reciprocating bar extends transversely across the entire machine and is pivotally supported upon the links 82 which are fixedly positioned for pivotal swinging movement at bearing pins 88.

An electric motor 98 drives a worm shaft which in turn rotates a worm wheel 97. Pitman 96 is pivotally connected to the worm wheel adjacent its periphery and the other end of the pitman it pivotally connected to the reciprocable bar 100. On operation of the motor the pitman 96 functions to reciprocate bar 100, and through their supporting connection with such bar the links 82 are swung back and forth in pendulum fashion to rotate bearing pins 88.

Depending below and integral with bearing pins 88 are links or arms 83, each of which is provided with a forked lower end as indicated at 92. A hollow leveling bar 80 spans the lower openings of the movable chutes and is suspended below them by means of arms 86 which are secured to rollers 90. These rollers 90 are positioned between bars or tracks 94 which extend transversely between movable chutes 73 and are secured thereto.

As links 83 swing back and forth due to the reciprocating movement of bar 100 driven through motor 98 and pitman 96, forks 92 which embrace rollers 90 force the said rollers back and forth along their transverse guideway in tracks 94. To the lower ends of arms 86 is secured a hollow leveling bar 80 which spans the movable chutes and is suspended by said arms below and in alignment with them. The tines of forks 92 are sufficiently long to maintain driving contact with rollers 90 as each fork moves in an arcuate path about pivot point 88, thus insuring positive drive contact through said tines to the leveling bar 80 during the full swinging movement of reciprocating drive bar 100. The motor 98 is controlled from the cab.

Beam 74 from which the movable chute and leveling bar assembly is suspended is raised and lowered within the enclosure 25 by means of a drum and cable arrangement positioned above the enclosure and broadly indicated by numeral 72, which is actuated by an electric motor controlled by the operator in the car.

It should be understood that the structural details heretofore set forth in connection with the movable chute and leveling bar assembly constitute no part of the invention, which resides in the assembly broadly and its cooperative relationship with other features described.

The gas-tight enclosure 25, which houses the door extracting and tightening mechanism as well as the movable chute and leveling bar assemblies, is connected by means of conduit 102 with a dust collector 104 from which conduit 106 conveys the

dust-freed gas to an outlet more particularly to be described. Passages 108 from within the oven open into standpipe 110 provided with a sealing cap 112 and communicating with a collecting main 114. A pneumatically operated gas shut-off valve 116 is arranged to be lowered into standpipe 110 when the sealing cap 112 is opened, and a vertically movable sleeve 118 is arranged for lowering around the standpipe and its open cap 112 to form a continuous passage from conduit 106 into the collecting main 114 when the gas shut-off valve 116 has been moved downwardly to seal the standpipe from the collecting main.

Preferably the upper surface of the standpipe is machined and a packing such as that illustrated in Fig. 4 is used for sealing the upper portion of the sleeve after it has been lowered.

Steam for purging is provided by means of a steam main 120 so that, when the gas shut-off valve 116 is raised and standpipe 110 is closed, the charging car may be freed of gas and the oven doors replaced. It will also be used to keep the car cool in case mechanical or other trouble interferes with normal operation.

My improved charging car is operated in the following manner: With the oven valved or sealed from the collecting main at the end of the coking period by means of a valve diagrammatically illustrated at 122, the standpipe cap 112 open and the usual accumulation of carbon in the standpipe and the neck or connection 123 to the collecting main either burned or cleaned off, the charging car will be placed over the oven. The operator will then lower the gas shut-off valve 116 and connect the steam main 120 to a header (not shown) available at each oven. Steam is not actually used, however, until a later period in the operation.

The door extracting and unlatching mechanism 48 will next be used to loosen the oven doors and elevate them by means of levers 50 into the recesses 26 of gas-tight enclosure 25, thus permitting subsequent movement of the movable chutes and leveling bars.

The movable coupling 27 associated with the gas-tight enclosure will then be lowered by means of pneumatic cylinders 28, which cylinders may be used to maintain pressure of each coupling on the machined surface of the door frame until charging is completed. At this point fluid is admitted to the flexible tube 44 to build up pressure to keep the packing blocks 42 tight against the coupling wall 30 and the wall of the enclosure.

The operator of the coke car under the coking chamber may now be signaled permission to withdraw coke from the oven. During this operation the dust that is usually carried out over the plant will be drawn up by the natural draft of the hot coking chamber into the enclosed passages of the charging car. The dust will be caught in the dust collector and the gases will pass off through conduit 106 into the air.

When the coke car operator has replaced the bottom door and purged the coking chamber and charging car to the air with steam from the bottom, the operator of the charging car will then connect conduit 106 extending from the dust collector to standpipe 110 by lowering sleeve 118 to the machined upper surface of the standpipe. Pressure should be maintained on this surface until the charging is finished. Of course the valve or seal 122 to the collecting main 114 will be opened.

The movable chute and leveling bar assemblies are then lowered to engage the stationary chutes 66 leading from hopper 64 and the oven charged by opening gates 68. Coal in excess of that needed for the oven charge is carried in the hoppers. The coal will flow through the chutes until the oven is filled to the bottom of the chutes, which after the lowering operation extend down into the ovens, and there will be a valley or depression between the chutes the depth of which is dependent on the angle of repose of the coal.

Hopper gates 68 are then closed and the leveling bar is operated to swing the same transversely across the peaks or elevations of the coal charge. This will allow the coal in the stationary chutes to flow out, after which the movable chutes and leveling bar may be lifted slowly a slight distance to a point where all the coal in the chutes will be leveled off.

With the coal charged and leveled, the operator then elevates the chutes and leveling bar, raises the gas shut-off valve 116, closes the standpipe cap 112, admits steam from main 120 to purge the gas from the car into the oven, and replaces and tightens the oven doors, after which the sleeve 118 and the movable couplings 27 are elevated.

Among the important advantages derived through use of my improved mechanism are the great saving in labor and control of the dust problem. While for purposes of illustration I have suggested herein the use of pneumatic and electric actuating means for performing certain of the important functions and disclosed specific constructions for enabling such performance, it is to be understood that the disclosure is intended to be exemplary and not by way of limitation of the invention as hereinafter set forth by the claims.

What I claim is:

1. In a device of the class described the combination of a gas-tight enclosure, movable means for coupling the same with an oven door opening, means for withdrawing the door of said opening, a chute within the enclosure adapted to be lowered through the door opening into the oven, a leveling bar positioned in said enclosure extending longitudinally of the opening below the end of said chute and similarly adapted, and means for lowering the chute and leveling bar into the oven.

2. In a device of the class described the combination of a gas-tight enclosure, movable means for coupling the same with an oven door opening, means for withdrawing the door of said opening, a chute within the enclosure adapted to be lowered through the door opening into the oven, a leveling bar positioned in said enclosure extending longitudinally of the opening below the end of said chute and similarly adapted, means for lowering the chute and leveling bar into the oven, and means for reciprocating said bar longitudinally of the opening.

3. In a device of the class described the combination of a gas-tight enclosure, movable means for coupling the same with an oven door opening, a coal feed hopper outside the enclosure having an opening, an open-ended chute inside the enclosure adapted to be lowered through the door opening into the oven to thereby place its open end in communication with the hopper opening, a leveling bar positioned in said enclosure extending longitudinally of the opening below the end of said chute and similarly adapted, means for lowering the chute and leveling bar into the oven, and means for reciprocating said bar longitudinally of the opening.

4. In a device of the class described the combination of a gas-tight enclosure, movable means for coupling the same with an oven door opening, conduit means including a dust collector extending therefrom and communicating with the atmosphere, a coal feed hopper outside the enclosure having an opening, an open-ended chute inside the enclosure adapted to be lowered through the door opening into the oven to thereby place its open end in communication with the hopper opening, a leveling bar positioned in said enclosure extending longitudinally of the opening below the end of said chute and similarly adapted, means for lowering the chute and leveling bar into the oven, and means for reciprocating said bar longitudinally of the opening.

5. In a device of the class described the combination of a gas-tight enclosure, movable means for coupling the enclosure with an oven door opening, means for removing the door of said opening into the enclosure, a coal feed hopper outside the enclosure having an opening, an open-ended chute inside the enclosure adapted to be lowered through the door opening into the oven to thereby place its open end in communication with the hopper opening, a leveling bar positioned in said enclosure extending longitudinally of the opening below the end of said chute and similarly adapted, means for lowering the chute and leveling bar into the oven, and means for reciprocating said bar longitudinally of the opening.

6. A device of the class described for use in conjunction with an oven having a standpipe communicable with a collecting main comprising a gas-tight enclosure, movable means for coupling the same with an oven door opening, conduit means extending from the enclosure and communicating with the atmosphere, movable means supported by said device adjacent the atmospheric conduit opening for coupling the conduit with the standpipe, means supported by said device for movement into a position sealing the standpipe from the collecting main, a coal feed hopper outside the enclosure having an opening, an open-ended chute inside the enclosure adapted to be lowered through the door opening into the oven to thereby place its open end in communication with the hopper opening, a leveling bar positioned in said enclosure extending longitudinally of the opening below the end of said chute and similarly adapted, means for lowering the chute and leveling bar into the oven, and means for reciprocating said bar longitudinally of the opening.

7. A charging car for use with coking ovens carrying thereon a gas-tight enclosure having at its lower extremity a vertically movable member for coupling said enclosure around an oven door opening in gas-tight relation, means positioned within said enclosure for loosening the fastenings of an oven door, and means for swinging the loosened door into said enclosure, whereby gases rising from the oven will pass into said enclosure.

8. A charging car for use with coking ovens carrying thereon a gas-tight enclosure having at its lower extremity a vertically movable member for coupling said enclosure around an oven door opening in gas-tight relation, means positioned wtihin said enclosure for loosening the fastenings of an oven door, means for swinging the loosened door into said enclosure at one side of the door opening, a coal conveying chute positioned within said enclosure, means for lowering said chute into the oven through the door opening, and means for connecting the lowered chute with a coal supply located outside said enclosure.

9. A charging car for use with coking ovens carrying thereon a gas-tight enclosure having at its lower extremity a vertically movable member for coupling said enclosure around an oven door opening in gas-tight relation, means positioned within said enclosure for loosening the fastenings of an oven door, means for swinging the loosened door into said enclosure at one side of the door opening, a coal conveying chute positioned within said enclosure, means for lowering said chute into the oven through the door opening, a coal hopper carried by the car beside said enclosure and having a valved stationary feed leading into said enclosure, and means for coupling said lowered chute with said stationary feed to transmit coal from the hopper into the oven.

10. A charging car for use with coking ovens carrying thereon a gas-tight enclosure having at its lower extremity a vertically movable member for coupling said enclosure around an oven door opening in gas-tight relation, means positioned within said enclosure for loosening the fastenings of an oven door, means for swinging the loosened door into said enclosure at one side of the door opening, a coal conveying chute positioned within said enclosure, means for lowering said chute into the oven through the door opening, means for connecting the lowered chute with a coal supply located outside said enclosure, and means for leveling the coal within the oven lowerable with said chute into the oven.

11. A charging car for use with coking ovens carrying thereon a gas-tight enclosure having at its lower extremity a vertically movable member for coupling said enclosure around an oven door opening in gas-tight relation, means positioned within said enclosure for loosening the fastenings of an oven door, means for swinging the loosened door into said enclosure at one side of the door opening, a coal conveying chute positioned within said enclosure, means for lowering said chute into the oven through the door opening, means for connecting the lowered chute with a coal supply outside said enclosure, a leveling bar lowerable with said chute into the oven, and means for oscillating said leveling bar while within the oven.

GRADY PADGETT.

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