April 23, 1940. J. S. POTTER 2,197,943

COKE OVEN CHARGE LEVELING APPARATUS

Filed June 12, 1937 2 Sheets-Sheet 1

Fig. 1

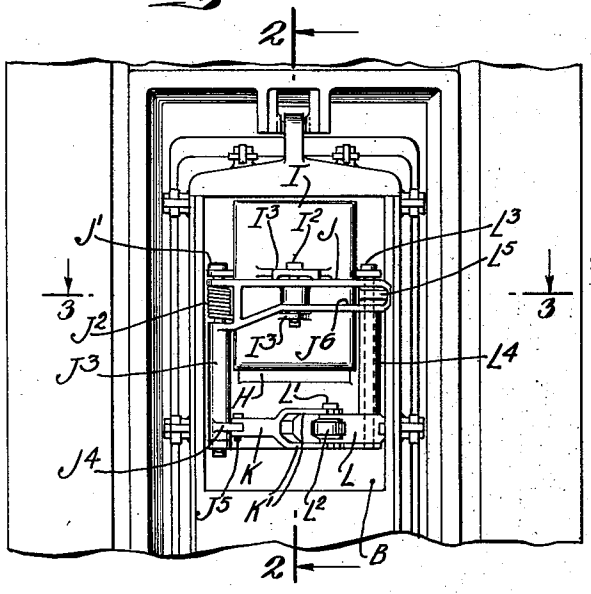


Fig. 2.

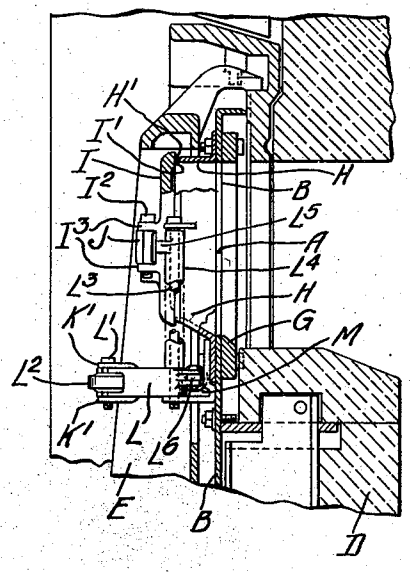
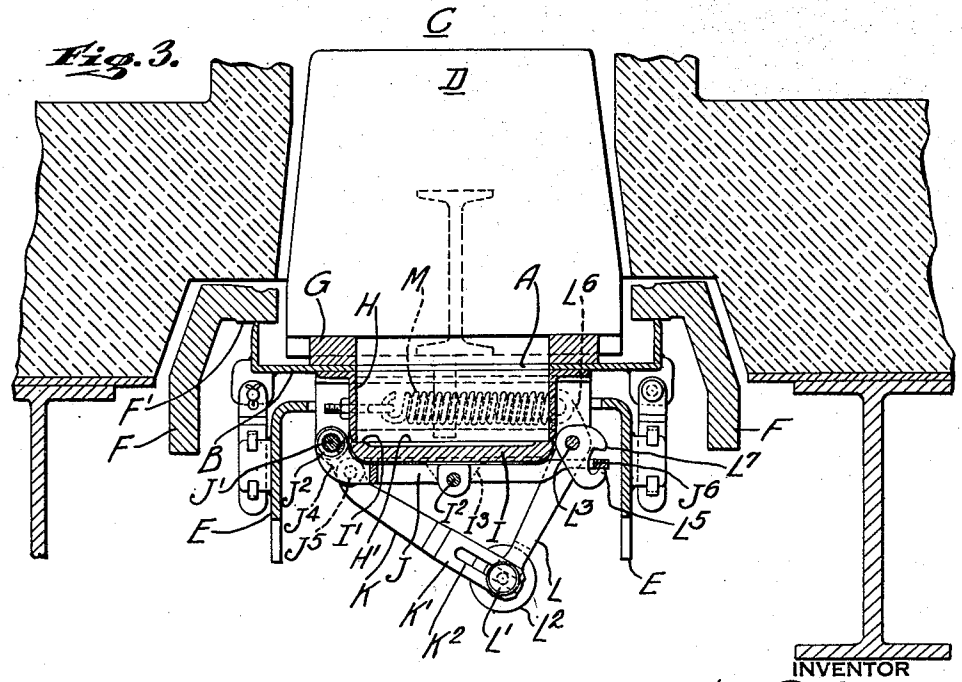


Fig. 3.

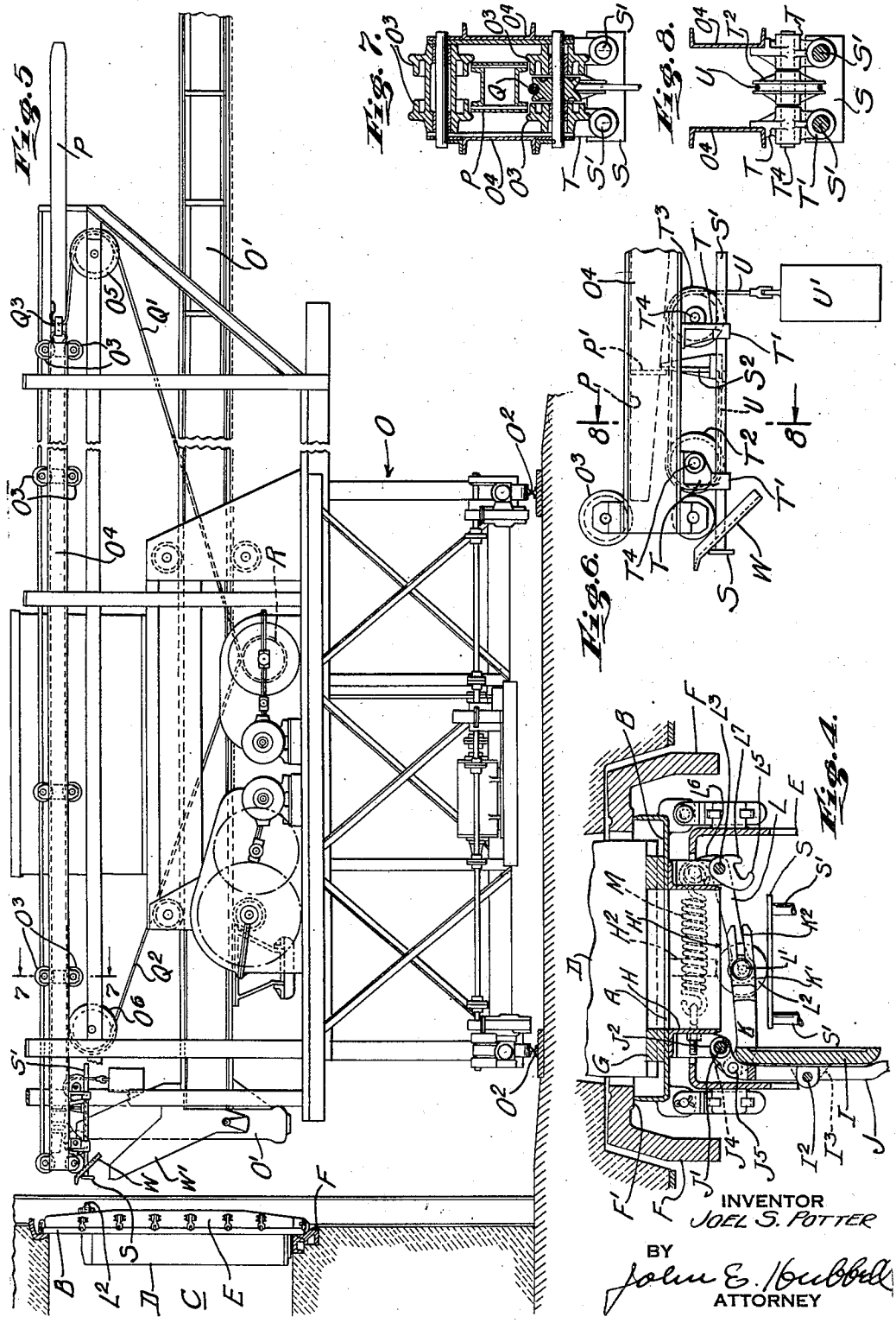


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COKE OVEN CHARGE LEVELING APPARATUS

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Patented Apr. 23, 1940 2,197,943

UNITED STATES PATENT OFFICE

2,197,943

COKE OVEN CHARGE LEVELING APPARATUS

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Application June 12, 1937, Serial No. 147,879

9 Claims. (Cl. 202—248)

The general object of the present invention is to provide improvements in the apparatus used in leveling the coal charges in the horizontally elongated coking retorts customarily employed in the manufacture of metallurgical coke.

In such coke ovens, each retort is customarily charged with coal in a granular condition passed into the oven through one or more charging holes in the oven roof. To level off the top of the charge and provide a gas collecting space of substantially uniform depth extending from one end to the other of the retort along the top of the latter, it is customary to employ a so-called leveling bar which is horizontally disposed, and is extended into the oven chamber, and worked longitudinally back and forth therein, during the charge leveling operation to smooth off the top of the charge. Customarily, the leveling bar and the mechanism for giving it its movements are mounted on the pusher machine employed to expel the finished coke from each retort through one end of the latter, by means of a pusher ram entering the retort at its opposite end. To permit the leveling bar to enter each retort, the latter must be provided with a suitable opening, and with a door, frequently called a chuck door, for closing the leveling bar opening at the leveling operation. Ordinarily, the leveling bar opening is formed in the upper portion of the pusher side coke oven door which normally closes the end of the coking chamber through which the coke expelling ram moves in the oven discharging operation.

More specific objects of the present invention are to provide a leveling bar, or chuck, door which is of simple and effective construction, and which is adapted to be unlocked and opened, and to be closed and locked automatically at the beginning and end respectively, of the leveling operation, and which is adapted to be so actuated by an operating part mounted on the pusher machine and moved by the leveling bar operating mechanism toward and into and out of operative engagement with and away from and out of engagement with the chuck door at the beginning and end, respectively, of the charge leveling operation.

A further specific object of the invention is to provide means actuated by the leveling bar actuating mechanism at the beginning and end of the charge leveling operation, not only to operate the chuck door as above described, but actuated also to adjust a chute into and out of position to receive coal worked out of the coking chamber through the leveling bar opening during leveling operation and to pass the coal received into a receiver provided for the purpose on the pusher machine.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a side elevation of a portion of a coke oven battery structure, including a leveling bar opening and a chuck door for closing said opening;

Fig. 2 is a partial vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 1, with the door for the leveling bar opening in its closed position;

Fig. 4 is a view taken similarly to Fig. 3 with the chuck door shown in its open position;

Fig. 5 is an elevation of a coke oven pusher machine provided with a leveling bar and an operating mechanism for the latter, with the portion of the coke oven structure at one end of which the pusher machine is located, shown in section;

Fig. 6 is an elevation on a larger scale, of a portion of the pusher machine shown in Fig. 5;

Fig. 7 is a section on the line 7—7 of Fig. 5; and

Fig. 8 is a section on the line 8—8 of Fig. 6.

In the drawings, I have illustrated an embodiment of the invention in which the leveling bar opening A for the coking chamber C of a horizontal coke oven battery, which may be of standard type, is formed in the sealing member B of the pusher side door which normally closes the corresponding end of the chamber C. The particular coke oven door shown, is a so-called plug type self-sealing door in which the sealing member B is a so-called through plate of sheet steel interposed between the inner plug section D and a rigid outer metallic section E of the door, and extending into overlapping relation with the sealing surface F′ of a metallic doorframe member F surrounding and forming a lining for the mouth of the oven chamber C. The coke oven door may be provided with any usual or suitable means for detachably securing it in its normally closed position, and for adjusting the marginal portion of the sealing member B relative to the rigid outer section E of the door as required, to

make the joint between the sealing member B and doorframe sealing surface F' gas tight.

A further description of the coke oven door construction illustrated, is unnecessary, as it forms no part of the present invention, which is adapted for use in coke ovens which have leveling bar openings formed in coke oven doors of various types, and indeed in coke oven structures in which the leveling bar openings are formed in portions of the coke oven structure above the pusher side doorways as is occasionally proposed. It is noted, however, that the particular coke oven door construction illustrated may well be of the form disclosed and claimed in one or another of various pending applications filed by me, including in particular my application Serial No. 147,878 filed concurrently with the present application.

In the form of the invention illustrated herein, the portion of the sealing member B adjacent the margin of the opening A, is clamped between an inner rectangular cast iron frame member G and an outer leveling bar door frame member H. The door frame member H may be a malleable iron casting, and extends several inches outwardly from the outer side of the sealing member B, terminating in an edge H', forming a seat for the check or leveling bar, door I. The latter, as shown, is a rectangular casting having a machined inner surface I' adapted to engage the seat H'. The door I is shown as loosely connected adjacent its center to a horizontal lever arm J, by a pivot pin I^2 which passes through the arm J, and has its ends supported in upper and lower projections I^3 from the door I. The lever arm J has a spring hinge connection with the door frame H at one side of the latter. The spring hinge connection comprises a pintle or shaft J', and a spring J^2 acting in the direction to hold the door I against its seat.

The arm J, as shown, is a casting including a depending hub portion J^3 surrounding the shaft J', and carrying an arm J^4 at a level below the bottom of the leveling bar door opening. The arm J^4 is connected by a pivot J^5 to one end of an arm K. The arm K is formed at its opposite end with bifurcations K', one above the other, and each formed with a longitudinal slot K^2 receiving the corresponding end of a pin or shaft L', which is carried by the end of an arm of a lever L and which supports a roller L^2. The lever L is pivotally connected by a vertical pivot pin L^3 to the door frame member H at the opposite side of the latter from the pivot J'. The lever L has an elongated hub portion L^4 provided at its upper end with a latch hook L^5, which, in the normal closed condition of the door I, extends through a slot J^6 formed in the lever J and engages the outer end wall of that slot, and thereby locks the lever J in its door closing position. The lever L is biased for movement in the counterclockwise direction, as seen in Fig. 4, by a tension spring M. The latter has one end connected to the door frame H at the side of the latter at which the pivot pin J' is located, and has its other end connected to a portion L^6 of the lever L at the rear side of pivot L^3.

As will be apparent, a horizontal door opening force applied to the roller L^2 in the direction of the axis of the oven, and tending to move the roller L^2 toward the oven, will turn the lever L clockwise about its pivot L^3 from its door closed position shown in Fig. 3 into the wide open door position shown in Fig. 4. The initial clockwise movement of the lever L brings the latch hook L^5 out of engagement with the lever J and a further initial movement of the lever causes a cam portion L^7 to engage the bar J and force the latter away from its seat against the action of the spring J^2. The seal between the door I and door frame H, which may be cemented together by dried coal distillates, is thus broken by the direct cam action of the part L^7 on the lever J. Thereafter, as the turning movement of the lever continues, the pivot pin L' engages the closed ends of the slots K^2 and the arms L and K then form a toggle connection between the pivot L^3 and the pivot J^5. As the pin J^5 is, and the pivot L^3 is not, free for bodily lateral movement relative to the door frame H, the straightening out of the toggle links L and K causes the door I to move rapidly into its wide open position shown in full lines in Fig. 4. The arm L is prevented from moving beyond its Fig. 4 position by the engagement of the roller L^2 with a stop shoulder portion H^2 of the door frame H. When the door opening force acting on the roller L^2 is removed, the door I is automatically returned to its closed position and the latch hook L^5 is automatically brought into locking engagement with the lever J by the joint action of the springs J^2 and M.

The leveling bar construction just described is adapted for automatic operation by means associated with the leveling bar operating mechanism. One arrangement for the purpose is illustrated in Figs. 5 to 8, wherein O represents a pusher machine of conventional type, including a ram O', and mechanism for advancing it to force the coke out of a coking chamber C, into line which the ram may be brought by movement along the back rails O^2. At the level of the upper portion of the coking chamber C, the machine O is provided with a guide way for a horizontal leveling bar P. The latter ordinarily is a composite structure formed from rolled shapes or bars in the general manner indicated in Fig. 7, and is supported and guided in its longitudinal reciprocatory movements by upper and lower roller elements O^3. The latter are journalled as shown in Fig. 7, in a stationary leveling bar guide structure having vertical side portions formed by channel bars O^4.

The leveling bar P is given its reciprocatory movement by means of a cable looped about a motor driven winding drum R^4 mounted on the machine O. One end portion Q' of the cable extends from the drum R about a pulley O^5 journalled in the machine O at the side of the latter remote from the coke oven structure. The other end portion Q^2 extends about a pulley O^6, journalled in the machine O, at the side of the latter adjacent the coke oven structure, and the end of each end portion Q' and Q^2 is connected by a connector Q^3 to a portion of the leveling bar P at which is always external to the coking chamber C. As will be apparent, the rotation of the winding drum R, gives longitudinal movements to the leveling bar P. Insofar as above described, the pusher machine with its leveling bar and means for supporting and moving the leveling bar embodies nothing novel with me, but is of well known construction.

In accordance with the present invention, the pusher machine O is provided with means for automatically operating the chuck door I. Said means, as shown, include a door actuating element S, which is adapted to reciprocate in the direction of the oven axis, and as shown is in the form of a cross head S, connected to the ends adjacent the coke oven structure of two

side by side, guide rod or stem elements S'. The latter are shown as located beneath, and parallel to the end portions of the guide frame members O^4 adjacent the coke oven structure. As shown the plungers S' are slidingly received in guide sleeve parts T' of brackets T. The latter are secured to the channels O^4, and provide bearings for the shafts T^4 of pulleys T^2 and T^3.

A cable U secured to a cross head S^2 carried by the plunger or stem parts S' extends from the latter toward the oven structure until it comes to the pulley T^2, about which the cable is looped. From the pulley T^2, the cable extends away from the oven structure to the pulley T^3 over which the cable extends. The depending end of the cable U is connected to a weight U' which is heavy enough to advance the door actuating device S into engagement with the roller L^2, and to thereafter move the roller L^2 into its door open position, shown in full lines in Fig. 4, whenever the advancing movement of the cross head S is not prevented by the leveling bar as it is when the leveling bar is in its retracted position. Then as shown in Fig. 5, the door actuator S is held in its retracted position, shown in Figs. 5 and 6, by the engagement of the upper end of the cross head S^2 with a transverse bar portion P', of the leveling bar. The motor drive for the winding drum R is amply powerful to retract the door actuator and the leveling bar P, notwithstanding the opposing force due to the weight U'.

As the leveling bar P is moved toward the coke oven structure, preparatory to a charge leveling operation, the door actuator S advances with the leveling bar to engage the roller L^2 and turn the latter clockwise until the advancing movement of the door opener is terminated by the movement of the roller L^2 into engagement with the door frame stop part H^2. As will be understood, the parts are proportioned to insure the opening of the door I before the front end of the leveling bar P moves into the path along which the door I turns into its open position.

In the preferred construction illustrated the chuck door actuating element S has mechanically connected to it, a short inclined chute W. The chute is so disposed that its upper end will be moved into a position beneath the outer portion of the door frame H, as the chuck door is being opened so that the chute may receive the coal worked out of the oven chamber through the chuck door opening A, during the charge leveling operation, and to pass the coal received into a hopper W', carried by the pusher machine for the purpose.

I am not the first to provide means for automatically adjusting a chute into position to receive coal worked out of the leveling bar opening during the charge leveling operation, and out of that position to provide clearance for the pusher machine movements. The means shown herein for adjusting the chute double are especially advantageous, however, because of their mechanical simplicity and effectiveness, as well as because they make use of and include the means provided for automatically moving the chuck door out of and back into its normal closed and locked position. I believe I am the first to provide for such automatic actuation of the door normally closing the leveling bar openings in horizontal coke oven chambers. The use of simple and effective means such as I have devised for automatically opening and closing such doors is advantageous not only from the labor saving viewpoint, but because the manual chuck door opening and closing operations are difficult, because of the chuck door location and temperature and because of the short time available for each door opening and closing operation under operating conditions which frequently prevail, and also because of the considerable risk that the manually actuated chuck doors will not be closed and locked as soon as they should be.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between positions in which it opens and closes said opening, and a toggle connection between said structure and door adapted to be straightened and thereby move said door to its open position, by a member moving toward said structure.

2. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between open and closed positions, and a toggle connection between said structure and door comprising two links, each pivoted at one end to one end of the other, and one having its second end pivotally connected to said door adjacent said axis, and the other having its second end pivotally connected to said structure at a distance from said axis, said links having their connected ends displaced from said structure when said door is in its closed position and being adapted to open said door when said connected ends are moved toward said structure.

3. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between positions in which it opens and closes said opening, a lever element hinge connected to said structure to turn about an axis parallel to the first mentioned axis and located adjacent the opposite side of the opening, said element including a part engaging said door and securing the latter in its closed position when said element is turned in one direction, and a second part engaging said door and giving the latter an opening movement on an initial movement of said element in the reverse direction, a link having one end pivotally connected to said door adjacent the first mentioned axis, and a lost motion connection between the second end of said link and element intermediate said axes, whereby said link does not oppose said initial movement of said element, and whereby said element and link form a toggle connection between said structure and door adapted to be straightened and thereby to move said door to

its open position by further movement of said element in said reverse direction.

4. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between positions in which it opens and closes said opening, a lever element hinge connected to said structure to turn about an axis parallel to the first mentioned axis and located adjacent the opposite side of the opening, said element including a part engaging said door and securing the latter in its closed position when said element is turned in one direction, and a second part engaging said door and giving the latter an opening movement on an initial movement of said element in the reverse direction, a link having one end pivotally connected to said door adjacent the first mentioned axis, a lost motion connection between the second end of said link and element intermediate said axes, whereby said link does not oppose said initial movement of said element, and whereby said element and link forms a toggle connection between said structure and door adapted to be straightened and thereby to move said door to its open position by further movement of said element in said reverse direction and bias means for moving said door into its closed position.

5. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between positions in which it opens and closes said opening, a lever element hinge connected to said structure to turn about an axis parallel to the first mentioned axis and located adjacent the opposite side of the opening, said element including a part engaging said door and securing the latter in its closed position when said element is turned in one direction, and a second part engaging said door and giving the latter an opening movement on an initial movement of said element in the reverse direction, a link having one end pivotally connected to said door adjacent the first mentioned axis, a lost motion connection between the second end of said link and element intermediate said axes, whereby said link does not oppose said initial movement of said element, and whereby said element and link form a toggle connection between said structure and door adapted to be straightened and thereby to move said door to its open position by further movement of said element in said reverse direction, and bias means acting separately on said door to move the latter into its closed position and on said element to turn the latter in said one direction.

6. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between positions in which it opens and closes said opening, a lever element hinge connected to said structure to turn about an axis parallel to the first mentioned axis and located adjacent the opposite side of the opening of said element and including a part engaging said door and securing the latter in its closed position when said element is turned in one direction, and a link having one end pivotally connected to said element intermediate said axes, and pivotally connected to said door adjacent the first mentioned axis, and uniting with said element to form a toggle connection between said door and structure, adapted to be straightened and to open said door by force applied to said connection and turning said element in a direction opposite to the first mentioned connection.

7. The combination with a coke oven structure having a horizontal coking chamber with a leveling bar opening at one end of said chamber, of a door for said opening hinge connected to said structure to turn about an axis adjacent one side of said opening between positions in which it opens and closes said opening, a lever element hinge connected to said structure to turn about an axis parallel to the first mentioned axis and located adjacent the opposite side of the opening of said element and including a part engaging said door and securing the latter in its closed position when said element is turned in one direction, and a second part engaging said door and giving the latter an opening movement on an initial movement of said element in the reverse direction, and a link having one end pivotally connected to said element intermediate said axes, and pivotally connected to said door adjacent the first mentioned axis, and uniting with said element to form a toggle connection between said structure and door adapted to be straightened by movement of the pivotal connection between said element and link toward said structure, and thereby to move the door into its open position.

8. The combination with a coke oven structure having a horizontal coking chamber and a leveling bar opening at one end of said chamber, of a door mounted on said structure, a door actuating member mounted on said structure and adapted to be moved from one position into a second position when engaged by a member moving toward said structure, and an operating connection between said actuating member and door, whereby the latter is moved to close and open said opening by movement of said actuating member into said one or into said second position, respectively, said actuating member being biased for movement into said one position.

9. The combination with a coke oven door structure having a leveling bar opening adjacent its upper end, of a chuck door mounted on said structure, an actuating member mounted on said structure and adapted to be moved from one position into a second position when engaged by a member moving toward said structure, and an operating connection between said actuating member and chuck door, whereby the latter is closed and opened by movement of said actuating member into said one or into said second position, respectively, said actuating member being biased for movement into said one position.

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