March 12, 1957 J. M. GILLOTT 2,784,849

COKE OVEN DOORS AND DOOR HANDLING MACHINES

Filed June 23, 1952 5 Sheets-Sheet 1

FIG. 1.

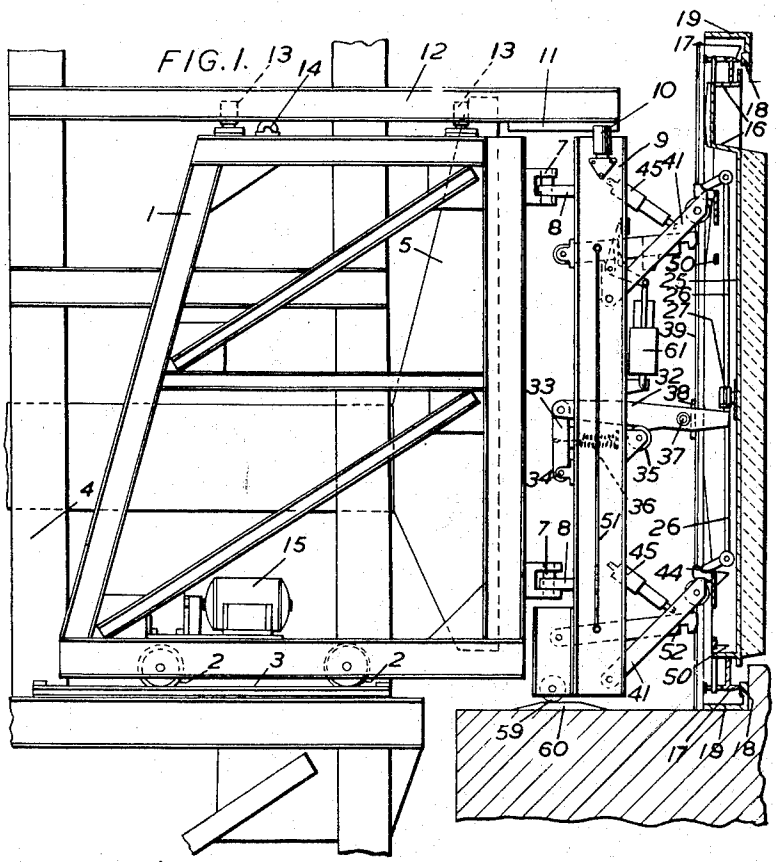
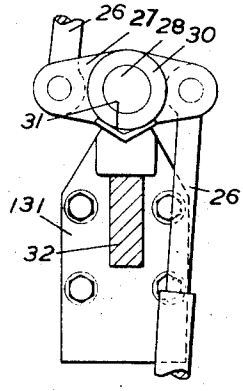


FIG. 4.



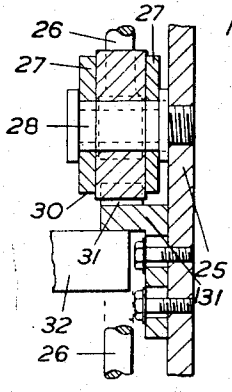
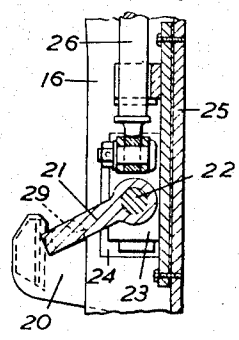


FIG 5

FIG. 6.



Inventor
JOHN M. GILLOTT

By
Clemmes, Keegin, Robinson & Clemmes
Attorneys

March 12, 1957 J. M. GILLOTT 2,784,849

COKE OVEN DOORS AND DOOR HANDLING MACHINES

Filed June 23, 1952 5 Sheets-Sheet 2

FIG. 2.

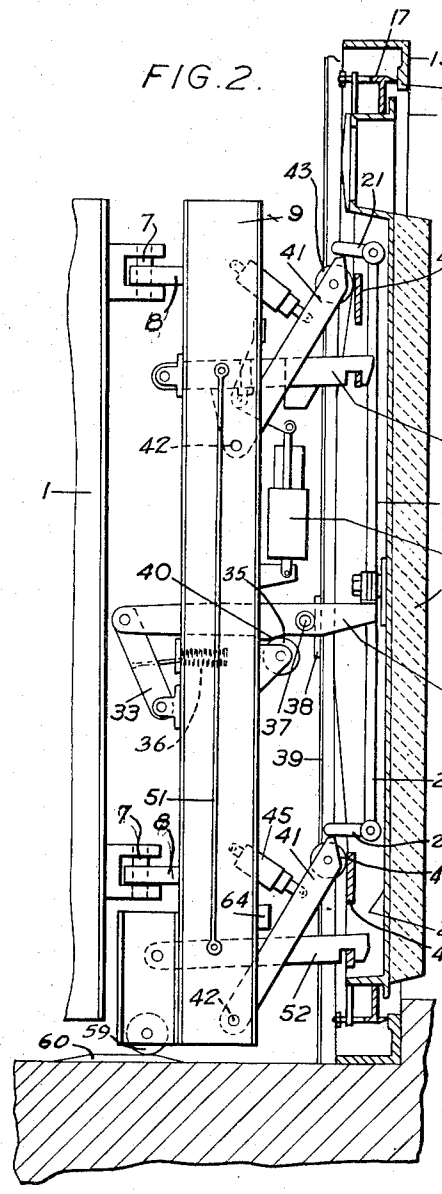
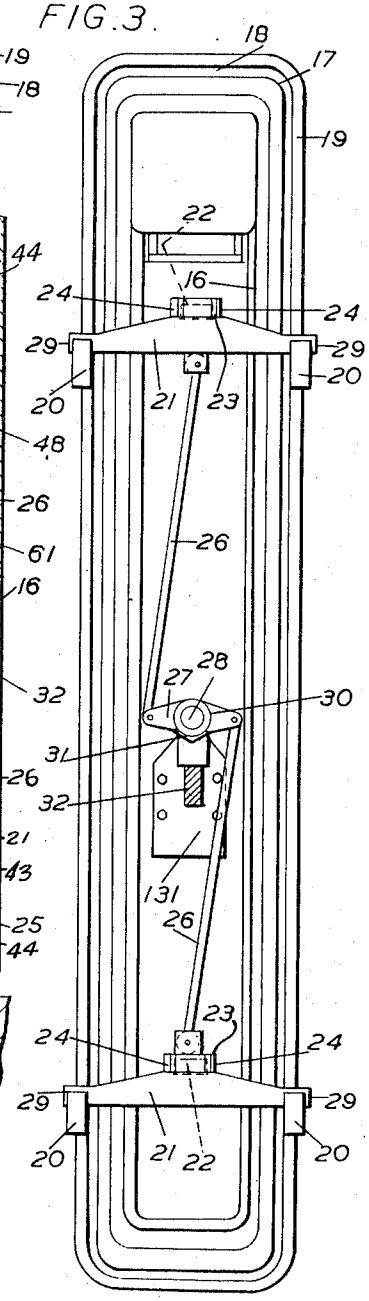


FIG. 3.



Inventor
JOHN M. GILLOTT

By
Clemmes, Kegan, Robinson & Clemmes
Attorneys

March 12, 1957 J. M. GILLOTT 2,784,849

COKE OVEN DOORS AND DOOR HANDLING MACHINES

Filed June 23, 1952 5 Sheets-Sheet 3

FIG. 7.

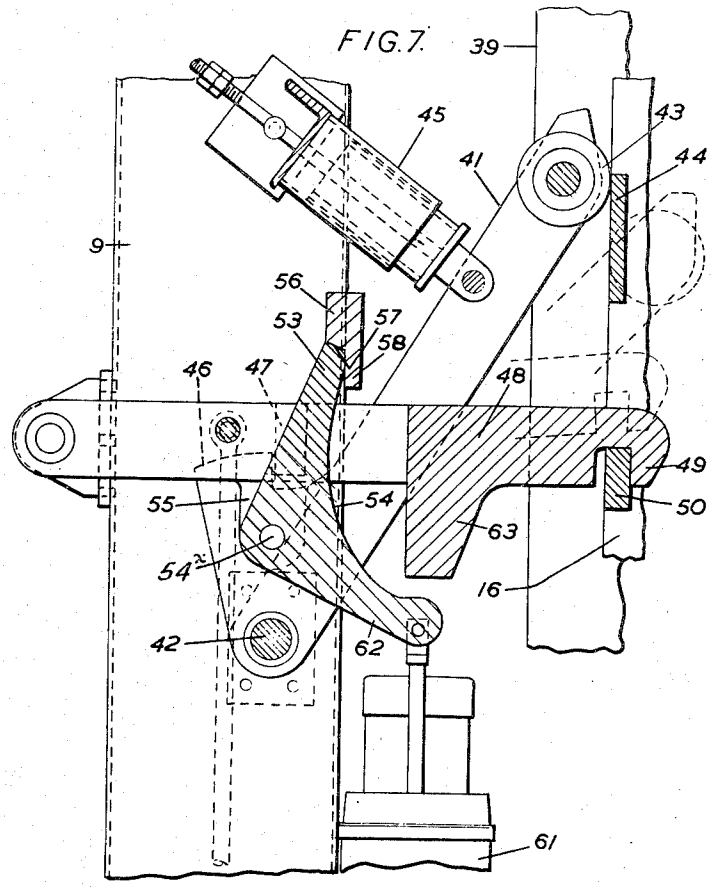
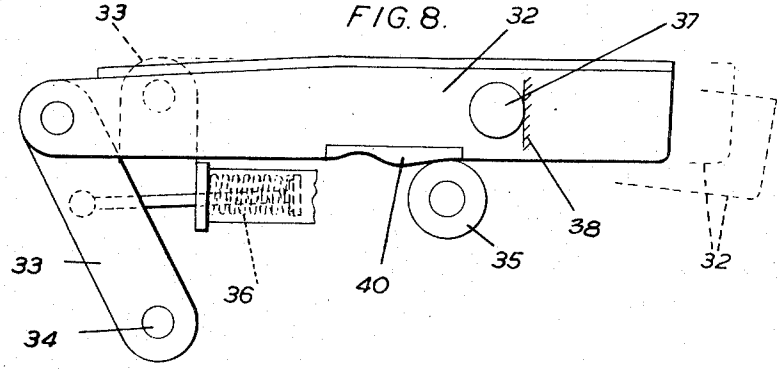


FIG. 8.



Inventor
JOHN M. GILLOTT

By
Clemmons, Keegin, Robinson & Clemmons
Attorneys

March 12, 1957 J. M. GILLOTT 2,784,849

COKE OVEN DOORS AND DOOR HANDLING MACHINES

Filed June 23, 1952 5 Sheets-Sheet 4

FIG. 9.

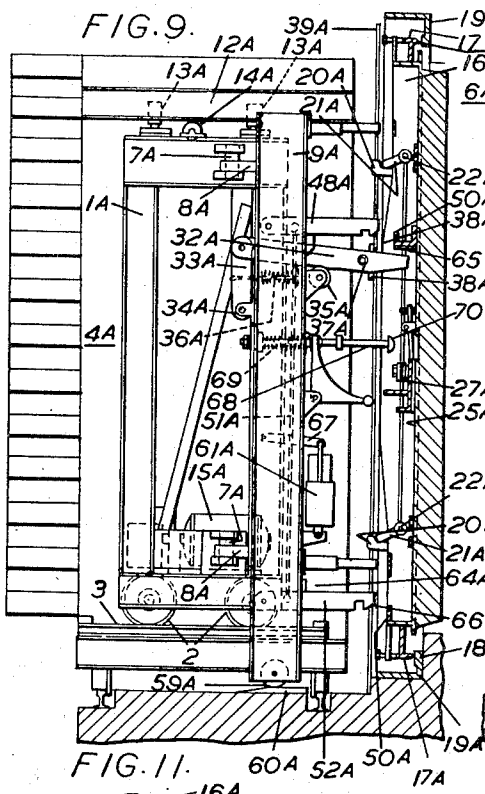


FIG. 10.

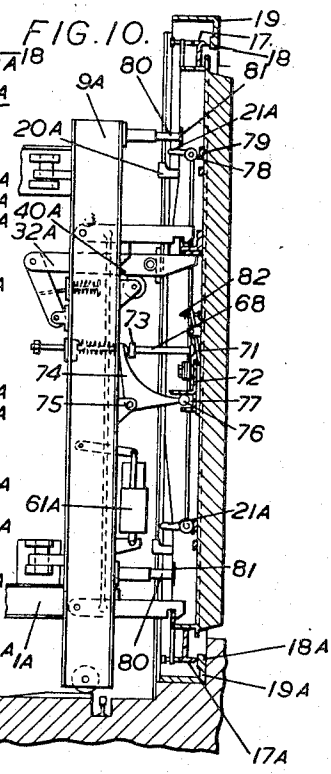


FIG. 11.

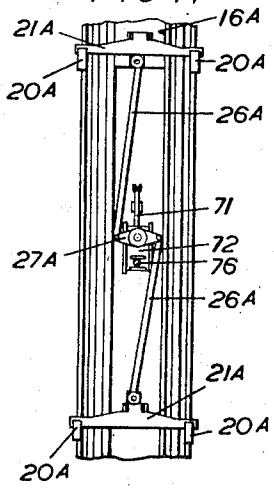
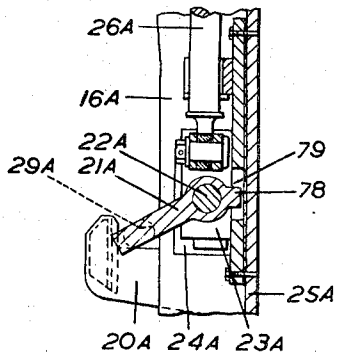


FIG. 12.



Inventor
JOHN M. GILLOTT

By
Semmes, Kleegin, Robinson & Semmes
Attorneys

March 12, 1957 J. M. GILLOTT 2,784,849

COKE OVEN DOORS AND DOOR HANDLING MACHINES

Filed June 23, 1952 5 Sheets-Sheet 5

FIG. 13

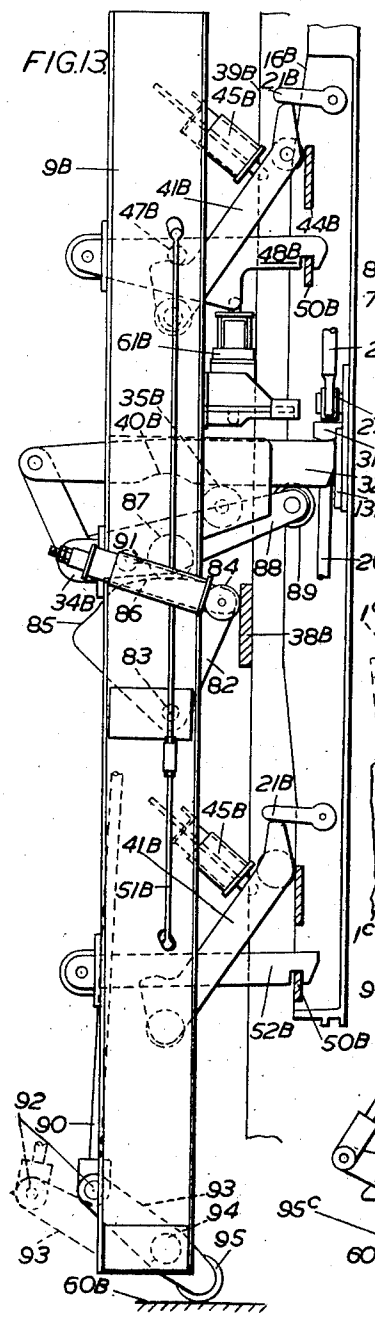
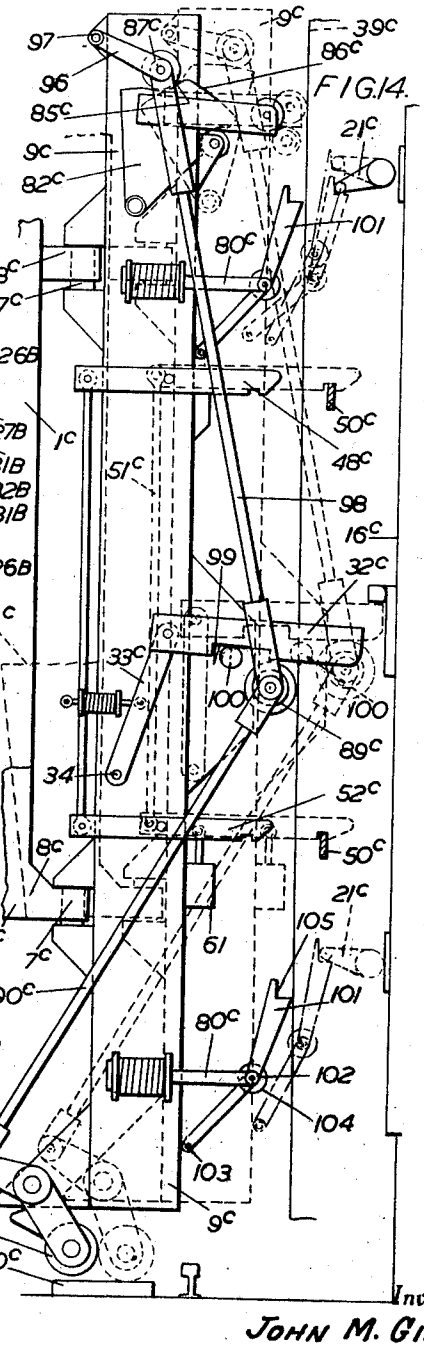


FIG. 14



Inventor

JOHN M. GILLOTT

By

Semmes, Keegan, Kobmann & Semmes

Attorneys

United States Patent Office 2,784,849 Patented Mar. 12, 1957

2,784,849

COKE OVEN DOORS AND DOOR HANDLING MACHINES

John Melville Gillott, Sheffield, England

Application June 23, 1952, Serial No. 295,045

5 Claims. (Cl. 212—4)

This invention relates to door handling machines for horizontal coke ovens, and is concerned with a machine for handling self-sealing doors of the kind described in U. S. Patent No. 2,759,884 in which locking bars movable relative to each other are disposed at different heights of the door to engage corresponding hooks on the oven structure to resolve the weight of the door into sealing thrusts and thrust-compensating gear interconnects the locking means to ensure simultaneous weight-resolution by the locking means and unfair distribution of the thrust between the locking means.

The main object of the invention is to provide a handling machine that takes the weight of the door and transfers the door to itself as the result of an approach movement towards the door, without applying any contacting thrust to the door itself as would endanger the self-sealing strips or like members. Other objects and advantages will appear from the following detailed description.

According to the present invention, a handling machine for such doors comprises an extractor head with a contact member adapted to contact part of the oven structure other than a door and movable with respect to the head on continuing movement of the head towards a door, and a door-supporting member movable to take the weight of the door, the contact member and the supporting member being so interconnected and mounted that the thrust of the contact member against the structure is resolved into an upward movement of the supporting member. The contact member thrust is applied by the movement of the head towards the door, but is taken by the structure, and not by the door, and, therefore, not by the sealing members round the door. Moreover, separate motor-driven mechanism does not have to be provided to effect transfer of the weight of the door to the head.

Further contact members may be provided to disengage the locking bars from the hooks by continuing movement of the head when the weight has been transferred to the head. Latch bars, preferably controlled by the further contact members, hook over catch bars on the door to hook the door positively to the extractor head.

Converse operations take place on the application of the door to the frame by the head, the weight being transferred from the supporting member to the frame after the further contact members have permitted re-engagement of the locking bars, and the latch bars being unhooked from the catch bars to allow the door to remain in the frame as the head is withdrawn. Again, the first thrust of the contact member connected to the supporting member on the approaching head is taken by the structure, not by the door.

The supporting member may be connected to the contact member by actually carrying it, being itself so mounted or formed that the resultant movement relative to the head after first contact is resolved into a lifting movement; or the contact member may be mounted on a separate member movable relative to the head, that member being so mounted or formed as to produce (through a connection to the supporting member) a lifting movement of the supporting member.

The operating height of the head may be related to the vertical position of an individual door by means of a guide surface placed at a predetermined height with respect to the door on the oven structure, the guide surface being engaged by the head in its approach to the door.

This invention will now be described in greater detail with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of a door handling machine with a door extractor head approaching a door to be removed;

Figure 2 is a corresponding view of the extractor head with its approach to the door completed;

Figure 3 is a front elevation of the door and the door frame;

Figure 4 is a front elevation of a detail of the door mechanism and an interengaging part of the extractor mechanism to a larger scale;

Figure 5 is a side elevation of Figure 4, partly in section;

Figure 6 is a side elevation, partly in section, of a detail of the door mechanism to a larger scale;

Figures 7 and 8 are side elevations (Figure 7 in part-section) of details of the extractor mechanism to a larger scale;

Figures 9 and 10 correspond to Figures 1 and 2, but show modified extractor and door mechanism;

Figure 11 is a front elevation of the middle section of the door of Figures 9 and 10;

Figure 12 is a side elevation, partly in section, of a detail of the door mechanism of Figures 9 and 10, to a larger scale; and

Figures 13 and 14 are side elevations of two further modifications of extractor and door mechanism.

In Figure 1, the carriage 1 of a door-handling machine is shown supported by wheels 2 on tracks 3 on a ramming and levelling machine 4 capable of being moved in the usual way along the ramming side of a battery of coke ovens to bring either the ram 5 or the carriage into operative alignment with any oven in the battery. The forward end of the carriage 1 carries two vertical pivot pins 7, on which lugs 8 at the rear of an extractor head 9 provide for pivoting of the head when it has picked up a door and been retracted in the machine 4. The head 9 consists mainly of two spaced vertical side members (one only visible), the space between them providing for the mounting of various elements described below. Rollers 10 at the top of the head 9 engage with guide rails 11 on beams 12 of the machine 4 to keep the head 9 aligned with the oven; the beams 12 also serve to guide the upper part of the machine 1, which is provided with vertical rollers 13 and a horizontal roller 14 to engage the beams.

The machine 1 is advanced and retracted by a motor 15. On full retraction, the rollers 10 clear the guide rails 11, when the head 9 may be pivoted about the pins 7 for better access to the face of a door carried by the head, to enable the door to be cleaned ready for replacement.

In Figures 1 and 2, a door 16 is shown making self-sealing contact through a sealing strip 17 with a face 18 of a door frame 19 secured to the oven structure. The door is carried by pairs of hooks 20 on the frame 19, through locking bars 21 mounted on horizontal pivots 22 in slides 23 vertically movable between guides 24 on the back plate 25 of the door (see also Figure 6). As shown in Figure 3, the slides 23 are connected by links 26 to the ends of an equalising lever 27 mounted on a

horizontal pivot 28 extending outwardly from the back plate 25 of the door.

With the two ends 29 of each locking bar 21 engaged in the corresponding hook 20, the centre-lines of each bar from their engagement with the hooks to the centre of the pivot 22 makes a small angle with the horizontal, so that the weight of the door is revolved into horizontal thrusts to urge the sealing strip 17 into contact with the door frame 19. Because of the interconnection of the slides 23 through the links 26 and lever 27, the horizontal thrusts at the two locking bars 21 are substantially equalised at upper and lower levels of the door, with consequent effective distribution of pressure over the length of the sealing strip. If either bar 21 makes contact with its hook 20 before the other bar 21 has made contact, any attempt of the first bar to exert its sealing thrust assists in forcing the other bar towards contact, so that both bars must make contact before the sealing thrusts can be developed.

The equalising lever 27 takes up a position about its pivot 28 in accordance with the positions assumed by the slides 23 in bringing the locking bars 21 into equalised engagement with the hooks 20. In the removal of the door, the weight of the door is taken by the machine 1 through the hub 30 of the lever 27, and engagement with the hub is through a flat V-notch 31 in a slide 131 contacted by the end of a supporting or lifting beam 32 (Figures 4 and 5). Thus, when the beam is lifted, it locks the lever 27 and the bar pivots 22 remain immovable in height with respect to the door 16. The bars thus remain correctly positioned for later replacement of the door.

Figure 1 shows the supporting beam 32 pivoted at its rear end to the top of a link 33 pivoted at a lower position 34 to the head 9 and supported by a roller 35 at the front of the head. A spring 36 urges the generally horizontal beam 32 forwardly, so that the beam acts as a push-rod. At the partial approach of the head 9 shown in Figure 1, a bar 37 carried by and projecting to each side of the beam 32 has just made contact with pads 38 on the oven buckstays 39. These pads are of such thickness or are so adjusted that at this time the forward end of the beam 32 is positioned below the notch 31 of the slide 131 of the lever 27, and clear of the back plate 25 of the door.

In the further approach of the carriage 1 to bring the head 9 to the position shown in Figure 2, the restraining contact between the bar 37 and the pads 38 causes the spring 36 to be compressed as the beam 32 forces the link 33 of the head rearwardly and downwardly. The roller 35 moves along a cam surface 40 on the underside of the beam 32 (see also Figure 8), and the combined action of the cam and the downward movement of the rear end of the beam under the swinging of the link 33 imparts an upward movement to the forward end of the beam and to the V-notch 31, sufficient to take up the initial clearance below the hub 30 and to take the weight of the door, the locking bars 21 then no longer transmitting the weight of the door to the hooks 20. A total movement of about 4" suffices, during much of which the sealing strips have been so much relieved of thrust that the actual lifting of the door is not accompanied by any vertical sliding of the sealing strips while they are under heavy sealing pressure against the sealing surface.

In the final part of the approach, pairs of links or levers 41 extending upwardly and forwardly from horizontal pivots 42 in the head 9 have each brought a roller 43 into contact with a plate 44 extending across the door front. The links 41 are urged outwardly by springs 45, which are compressed by the contact made by the rollers 43. The ends of the links 41 engage the underside of the locking bars 21 (now relieved of thrust) and swing them about their pivots 22 until the ends 29 are clear above the hooks 20.

The links 41 are interconnected with the latches for hooking the door to the head 9. The upper pair of links 41 have a shoulder 46, which lies below a crossbar 47 (Figure 7) of an upper latch 48 to form a stop that prevents dropping of the latch until the hooked end 49 has passed over a catch bar 50 extending across the door. A link 51 similarly controls a lower latch 52. Dropping of the upper latch 48 brings the upper end 53 of a catch lever 54 pivoted at 54× on lugs 55 of the latch 48 down the face of a catch bar 56 on the head 9 and into a notch 57 formed by the bar 56 and a second bar 58 across the side members of the head 9. The latch bars 48, 52 cannot now disengage from the bars 50, since the latch bar 48 is held engaged by the catch bar 56 through the catch lever 54.

The weight of the door now being taken by the machine 1, the locking bars 21 being lifted clear of the hooks 20, and the door 16 being latched to the head 9 by the engagement of the latches 48, 52 with the bars 50, the door may be removed by a withdrawal of the carriage 1 by reverse operation of the motor 15. The operative end of the supporting beam 32 remains in contact (via the V-block 31) with the hub 30 of the lever 27 as the bar 37 on the beam 32 leaves the plates 38 on the buckstays 39, the roller 35 by this time having engaged the underside of the beam 32 beyond the roller 40, with the beam swung by the backward movement of the link 33 into a position where it retains the weight of the door.

Removal of the door thus involves a partial approach of the carriage 1 (which may be rapid to the position shown in Figure 1), then a slower approach to the position shown in Figure 2, and a withdrawal of the machine (which may be slow at first, then rapid). During the initial advance, a roller 59 in bearings at the bottom of the head 9 rides up a ramp 60 set with its top surface at a predetermined height with respect to the oven 6 to bring the head 9 to a correct height for engagement of the supporting beam 32, links 41, and latches 48, 52 with the corresponding members of the door of that particular oven. The use of the pad 60 eliminates discrepancies in vertical dimensions, as of the door frame in the oven structure, or the height of the machine track with respect to the structure. The head is thus always brought to the correct height at any particular oven. The vertical pivots 7 provide sufficient play for the lugs 8 to allow the head 9 to be lifted by the ramp 60. Figures 13 and 14 show an alternative arrangement with a roller having controlled movement on the head, to be pressed on to a supporting surface by mechanism interconnected with the supporting beam mechanism.

With the head 9 withdrawn to bring the roller 10 clear of the guides 11, the head may be swung about the pivots 7 to enable the sealing strips to be cleared of tar before the door is returned to the oven.

Replacement of the door 16 is effected by a similar approach, first rapid, then slow, during which the bar 37 contacts the pads 38, and the links 41 keep the locking bars 21 above the hooks 20, the position shown in Figure 2 again being reached. When it is seen that the sealing strips 17 are correctly seated, a thruster 61 is operated. This is connected to an arm 62 of the catch lever 54, and its first result is to free the upper latch 48. Next, the thruster drives the arm 62 against a lug 63 on the latch 48 to lift the latch, and—through the link 51—the latch 52. The lower latch closes a limit switch 64 in the withdrawal circuit of the motor 15, so that withdrawal is dependent on the door having been unlatched. The limit switch 64 has previously been opened when the latches 48, 52 have been allowed to fall to engage the door to the head, and the switch may thus be used to stop the forward movement of the machine when this engagement has been effected. A slow withdrawal then allows the links 41 to lower the locking bars 21 into the hooks 20

(and to hold the latches lifted by the shoulder 46 again passing under the cross-bar 47); then the lowering of the operative end of the supporting beam 32 transfers the weight of the door to the hooks 20 through the locking bars 21 for the equalising sealing thrust to be applied, and the beam 32 is brought clear of the hub 30 of the equalising lever 27. The beam 32 is re-set by the spring 36, and the links or levers 41 by the springs 45, the springs 45 also serving to urge the door away from the head, i. e., towards the door frame.

A similar door handling machine is employed at the discharge side of the battery.

Except for the operation of the thruster 61 to disengage the latches 48, 52 to leave a door to be left in its frame when placed by the machine, the placing and withdrawal of a door result solely from similar movements of the extractor head 9 towards and away from the oven structure. The power required to transfer the weight of the door from the hooks 20 to the extractor head (via the beam 32) is derived from the approach movement of the head 9; the reverse transfer of weight to the hooks 20 in the placing of a door is controlled by the withdrawal of the head 9 from the oven structure.

Accurate vertical alignment of the head 9 and its mechanism with a door to be withdrawn is ensured by the roller 59 and the ramp 60. Horizontal positioning of the head and its mechanism is ensured by contact of the bar 37 with the buckstays. This brings the beam 32 into position to receive the weight of the door after a slight lift of the forward end of the beam. The contact of the extractor mechanism from which operation of the beam 32 results is against the oven structure—not against the door—and the sealing strip 17 is not subjected to extra thrust. If the buckstays become distorted, the pads 38 are appropriately adjusted to control the first contact made by the bar 37.

The locking bars 21 are relieved of thrust as the weight is taken by the head 9, and are free to be swung clear of the hooks 20, thus making it unnecessary to lift the door itself over the substantial height that would otherwise be necessary to clear the bars 21 from the hooks. Consequently, vertical movement of the sealing strip 17 while in contact with the sealing face 18 is reduced to small extent, while the sealing strip has been relieved of thrust.

The door is thus placed in its frame by a movement that is mainly horizontal, and this assists in the correct fitting of the sealing strip of a particular door to the sealing face of a particular door frame to which it has been adjusted. Then, when the bars 21 have been re-engaged in the hooks 20, the sealing thrust derived from the weight of the door is brought into operation as the supporting beam 32 is relieved of the weight, and the equalising connection between the bars 21 ensures that the sealing thrust is satisfactorily distributed.

The parts of the mechanism should be so proportioned and adjusted that the door does not rest on the soleplate of the oven; the full weight of the door is then available for resolution into equalised sealing thrusts. The parts of the mechanism lend themselves to robust construction, adequate to withstand the stress of handling the heavy door and capable of placing it with considerable precision against its frame. The mechanism of the machine is positive in action in its operation of the door and provides for the simple control of locking mechanism on the door that produces equalised sealing thrusts without relying on the resilience of springs in positions necessarily exposed to the considerable heat of the oven.

The operation may be summarised:

To remove a door 16 from the oven, the carriage 1 and head 9 are advanced on the machine 4 by the motor 15 to bring the end of the beam 32 under the notch 31, and the head 9 continues to advance after the beam 32 has been checked by the bar 37 on the beam 32 encountering the pads 38 on the oven structure, so that the beam

is lifted by the cam 40 running over the roller 35. The weight of the door 16 is thus taken by the head 9.

The advance of the head 9 also brings the links 41 into contact with the door itself, thus thrusting their ends upwards to release the locking bars 21 from the hooks 20 for complete release of the door from the oven structure. The advance of the head 9 also allows the latches 48, 52 (already in lowered position) to snap over the bars 50 on the door, so that the door is engaged to the head and is withdrawn by it on reverse actuation of the motor 15.

To replace in the door frame a door 16 already supported on the beam 32 and engaged by the latches 48, 52, a similar advance is made by the head 9. With the door placed within the door frame, but still supported by the head, the thruster 61 is operated to raise the latches 48, 52, so that withdrawal of the head 9 first allows the links 41 to lower the locking bars 21 into position to engage the hooks 20 and then causes the beam 32 to lower, to allow the weight of the door to be taken by the hooks 20 and the sealing thrusts to be developed by the lockings bars 21.

Figures 9 and 10 show a modified machine, in this instance shown applied at the discharge side. Although modified in shape, the carriage of the machine and the extractor head are essentially the same as in Figures 1 and 2; and, for simplicity, like parts are designated by the same reference numerals, with the suffix A.

The supporting beam 32A makes contact with a bracket 65 fixed to the back plate 25A of the door 16A. The latches 48A, 52A have inclined leading ends 66 to snap over the bars 50A. The thruster 61A operates a lever 67 to release the latches through the connecting link 51A.

A push rod 68 carried by the head 9A is urged forwardly by a spring 69. The end 70 of the push rod presses a catch lever 71 (Figures 10 and 11) clear of the upper end of a vertical slide 72 on the door 16A by which the equalising lever 27A is carried. A collar 73 on the push rod 68 then operates one arm of a bell-crank lever 74 pivoted at 75 on the head 9A for the other arm 76 (now lying in a cavity 77 in the slide 72) to lift the slide. The resultant lift of the equalising lever 27A lifts both locking bars 21A and then causes snugs 78 (Figure 12) at the rear of the locking bar pivot hubs to make contact with stops 79, thus causing the bars 21A to rock clear of the hooks 20A.

With a slow advance of the head 9A from the position of Figure 9 to that of Figure 10, the beam 32A takes the weight of the door; the equalising lever slide 72 is freed from the catch lever 71; the slide 72 is lifted to lift the equalising lever 27A, so that the locking bars 21A are first eased in the hooks 20A and then rocked clear of the hooks; and the latches 48A, 52A snap into position. In the latter part of the advance, spring plungers 80 projecting from the head 9A are compressed against plates 81 extending across the door. The door may now be withdrawn.

Replacement of the door is effected by an advance of the head 9A and door 16A to the position of Figure 10, when maintained operation of the thruster 61A lifts the latches 48A, 52A, and holds them clear as the head is retracted, the plungers 80 then pressing the door away from the head and against the frame 19A. The lever 74 allows the slide 72 to fall, for the locking bars 21A to re-engage the hooks 20A and apply equalised thrusts via the sealing strips 17A as the supporting beam 32A is lowered from the bracket 65, the catch lever 71 being pressed by a spring 82 over the slide 72.

Figure 13 shows modifications of mechanism generally similar to that of Figures 1 and 2. Like parts are again designated by the same reference numerals, with the suffix B.

The supporting beam 32B is lifted by means of a cam 82 pivoted at 83 to the head 9B when rollers 84 contact plates 28B on the buckstays 39B. The cam surface 85 that provides the lift continues to a concentric surface 86 to maintain the lift. A follower roller 87 is carried

by a lever 88 pivoted at 34B and ends in a roller 89 to engage the underside of the beam 32B.

A link 90 pivoted at 91 to the lever 88 is pivoted to the rear end 92 of a lever 93 pivoted at 94 at the bottom of the head 9B. The forward end of the lever 93 carries a roller 95 that is thrust down into contact with a pad 60B set at a predetermined height with respect to the door frame, so that the head 9B is brought to correct engaging height.

The thruster 61B engages the upper latch 48B directly, but could equally engage it through a catch lever similar to the lever 64 in Figure 6.

Figure 14 shows a further modification, with like parts to those appearing in other figures designated by the suffix C.

The cam 82C is located at the top of the head 9C, and its follower roller 87C is carried by a link 96 pivoted at 97. The roller end of the link 96 is connected by a link 98 to a lifting roller 89C under the supporting beam 32C. With the beam 32C lifted, a notch 99 is brought clear of a roller 100, and the final advance of the head 9C brings the roller 100 under the forward end of the beam to maintain the lift.

The link 98 is connected, by its end carrying the roller 89C, to a link 90C to thrust a roller 95C into contact with a pad 60C, to bring the head 9C to a predetermined height.

The locking bars 21C are lifted by levers 101 pivoted at 102 to thruster arms 80C and continuing to make rolling contact at 103 with the front edge of the head 9C. Rollers 104 on the arms 80C first make contact with plates on the buckstays to compress the thrusters, and further advance of the head 9C swings the levers 101 about the pivot 102 to bring notched ends 105 into lifting contact with the locking bars 21C. The thrusters 80C urge the door away from the head during the replacement of the door.

What I claim is:

1. A door-handling machine for a self-sealing door for a horizontal coke-oven in which the door has locking bars that not only serve to lock the door by engaging hooks on the door frame but also transmit the weight of the door to the hooks and are interconnected to each other so as to produce equalised sealing thrusts derived from the weight of the door, together with at least one latch bar on the door, said machine comprising an extractor head movable towards and away from an oven structure, two distinct contact means carried by and movable with respect to the head, and adapted respectively to contact the oven structure and the door structure, a door-supporting beam pivoted on the head and carrying the first contact means, a roller-and-cam connection between the beam and the head to effect a weight-taking movement of the beam when the contact means encounter the oven structure in an approach movement, the other contact means serving to disengage the locking bars from the hooks in a further approach movement as a result of consequent relative movement between the other contact means and the head, and a latch on the head to engage a latch bar on the door and secure to the head a door whose weight has been taken by the head from the hooks engaged by the locking bars, thus enabling the head to move the door away from the oven structure.

2. A door-handling machine for a self-sealing door for a horizontal coke-oven in which the door has locking bars that not only serve to lock the door by engaging hooks on the door frame but also transmit the weight of the door to the hooks and are interconnected to each other so as to produce equalised sealing thrusts derived from the weight of the door, together with at least one latch bar on the door, said machine comprising an extractor head movable towards and away from an oven structure, two distinct contact means carried by and movable with respect to the head, and adapted respectively to contact the oven structure and the door structure, a door-supporting member mounted on but movable with respect to the head and connected to the first contact means to take the weight of the door when the contact means encounter the oven structure in an approach movement as a result of consequent relative movement between the contact means and the head, locking-bar engaging members connected to the other contact means to disengage the locking bars from the hooks in a further approach movement as a result of consequent relative movement between the other contact means and the head, a latch on the head to engage a latch bar on the door and secure to the head a door whose weight has been taken by the head from the hooks engaged by the locking bars, thus enabling the head to move the door away from the oven structure, a shoulder on a locking-bar engaging member, and a cross-bar on the latch positioned to rest on the shoulder to hold the latch lifted until movement of that engaging member by its door-contacting means removes the shoulder from the cross-bar.

3. A door-handling machine as in claim 2, comprising two interconnected latches, one of which is held lifted by the interconnection when the other is held lifted by the shoulder.

4. A door-handling machine as in claim 2, comprising a catch lever pivoted on the latch, a catch bar on the head to be engaged by the lever when the latch engages its latch bar, to prevent disengagement of the latch, and latch-disengaging means connected to the catch lever.

5. A door-handling machine as in claim 2, wherein the locking-bar engaging members extend forwardly and upwardly from pivots on the heads, for their upward and forward ends to make contact with the door in an approach movement.

References Cited in the file of this patent

UNITED STATES PATENTS

1,141,132	McIntire	June 1, 1915
2,123,521	Berg	July 12, 1938
2,157,567	Potter	May 9, 1939
2,182,494	Lavely	Dec. 5, 1939
2,299,916	McIntire	Oct. 27, 1942
2,598,582	Melzer	May 27, 1952