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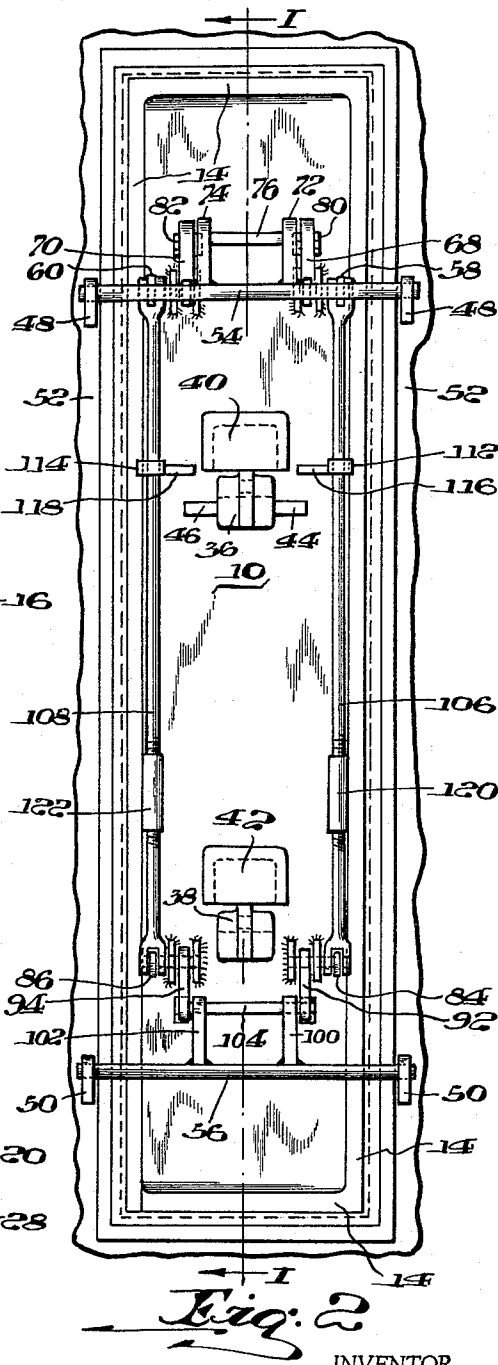
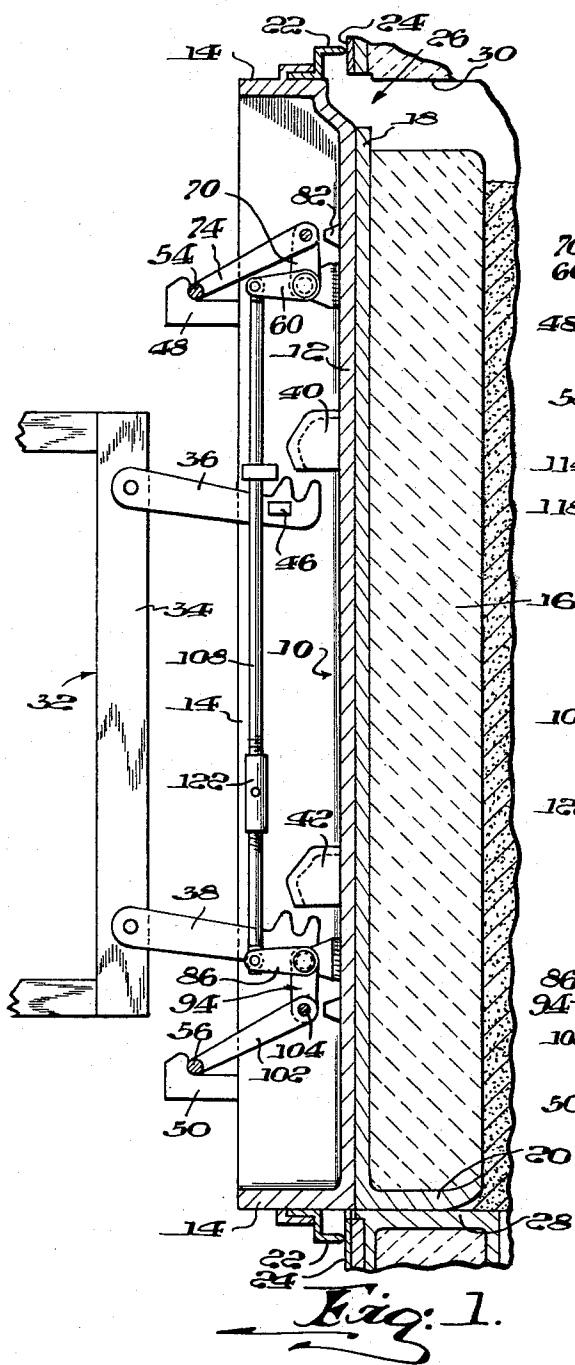
L. G. TUCKER

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COKE OVEN DOOR LATCHING MECHANISM

Filed May 15, 1964

2 Sheets-Sheet 1



INVENTOR.
LINWOOD G. TUCKER.

BY *Stanley I. Tucker*
his ATTORNEY.

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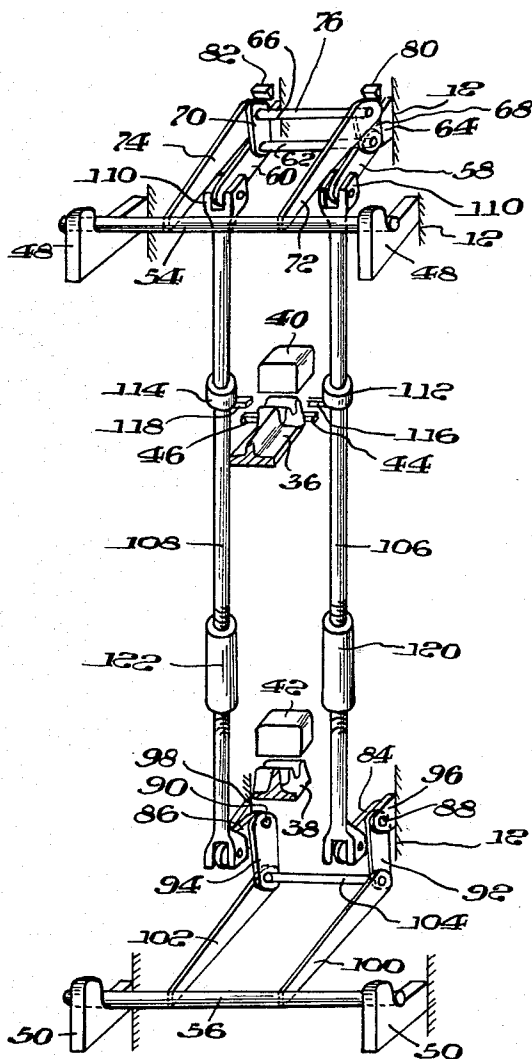
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INVENTOR.
LINWOOD G. TUCKER.
BY *Stanley I. Stein*
his ATTORNEY.

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COKE OVEN DOOR LATCHING MECHANISM
Linwood G. Tucker, Pittsburgh, Pa., assignor to Koppers
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This invention relates to improvements in a coke oven door and more particularly to a latch mechanism for the coke oven door that exerts substantially the same latching force on all the retaining members projecting from the coke oven structure.

In the past coke oven doors have been maintained in a closed position by means of one or more transverse locking or latching bars on the door engaged in hook-like retaining members affixed to the coke oven structure on opposite sides of the door frame. The transverse latching bars are disengaged from the retaining members by movement in planes substantially parallel to the door. Where a pair of transverse latching bars are utilized adjacent the upper and lower portions of the door, separate lever-like actuators have been provided to move the transverse latching bars into and out of engagement with the hook-like retaining members so that there has not been, in the past, any assurance that both of the transverse latching bars are exerting a proper proportion of the force that maintains the door in a proper closed position.

It is highly desirable that the coke oven doors in a closed position produce a uniform pressure on the sealing edge extending around the door jamb. In oven doors where the weight of the door exerts this latching pressure and a pair of separately actuated transverse latching bars are utilized, it is difficult to provide a substantially equal engaging force by both of the transverse latching bars.

It has been determined that the latching force, where the weight of the door is used to obtain the latching closure pressure, is equal to the weight of the door multiplied by the cotangent of the angle of inclination of the inclined lever connected to the transverse latching bar. For example, where the angle is between 25° and 30° and the weight of the door is approximately 8,000 pounds, the latching force exerted by the door will range from about 13,000 to 17,000 pounds. Where this latching force is unevenly distributed between the respective transverse latching bars the undesirable condition of the uneven distribution of the latching force on the transverse latching bars is apparent.

It has been discovered by interconnecting the lever mechanisms associated with both of the transverse latching bars, as hereafter described, that it is now possible to obtain substantially the same latching force on both of the transverse latching bars.

Briefly, the invention includes upper and lower lever means pivotally connected to the coke oven door and having transverse engaging or latching means secured to one end thereof. A connecting means connects the upper and lower lever means so that both of the lever means simultaneously pivot about their respective pivot connections and move the upper and lower transverse latching means into and out of engagement with the upper and lower retaining members. Upon engagement, because of the connecting means therebetween, both of the transverse latching means exert substantially the same latching force on both the upper and lower retaining members.

Accordingly, the principal object of this invention is to provide a coke oven door that exerts substantially the same latching force on the upper and lower hook-like retaining members.

Another object of this invention is to provide a connecting means between the upper and lower transverse latching bars on a coke oven door to thereby equalize

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the latching force exerted by the latching bars on the retaining members affixed to the coke oven structure.

Another object of this invention is to provide a latching mechanism for a coke oven door that provides uniform loading on each latching bar.

These and other objects and advantages of this invention will be more completely disclosed and described in the following specification, the accompanying drawings and the appended claims.

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

FIGURE 1 is a vertical section through a coke oven door taken along the line 1-1 of FIGURE 2 and illustrating the latch mechanism constructed in accordance with the herein disclosed invention.

FIGURE 2 is a front view of the coke oven door illustrated in FIGURE 1.

FIGURE 3 is a fragmentary perspective view of the door latch mechanism illustrated in FIGURES 1 and 2.

As illustrated in FIGURES 1 and 2, the coke oven door generally designated by the numeral 10 includes a rectangular plate-like body portion 12 having a peripheral outwardly extending rib 14. Secured to the inner surface of the door 10 is a rectangular door plug 16 formed of a refractory material positioned in a metallic receiver 18 having an inwardly extending lower portion 20. The inwardly extending portion 20 is arranged to abut and be supported by a horizontal metallic stoop indicated by the numeral 28. Secured to the peripheral outwardly extending rib 14 is a peripheral sealing means 22 that abuts the coke oven door jamb or front surface 24 around the rectangular opening 26 formed in the horizontal coking chamber. The door 10 is arranged to seal the elongated vertical openings in the horizontal coking chamber on both the coke side and the pusher side of the coke oven battery. The vertical dimension of the refractory plug 16 that extends into the opening 26 is less than the vertical dimension of the coking chamber so that the coke oven door 10 can be moved vertically as the door is being positioned in and removed from the opening 26. This spacing between the door plug 16 and the lower portion of the oven roof 30 is illustrated in FIGURE 1.

The coke oven door 10 is positioned in the oven chamber opening 26 by a door extracting mechanism 32, a portion of which is illustrated in FIGURE 1. The door extracting mechanism includes a vertical frame or beam member 34 having a pair of extraction hooks 36 and 38 associated therewith. The hooks 36 and 38 are arranged to engage receiver members 40 and 42 which are secured to and extend outwardly from the oven door body portion 12. Thus the door extracting mechanism is moved into position adjacent the coke oven door 10 and the extraction hooks are moved into engagement with the receivers 40 and 42. Upward movement of the extraction hooks 36 and 38 through either a pivotal arrangement on the frame 34 or upward movement of the frame 34 moves the coke oven door upwardly so that the lower portion of the door is spaced from the stoop 28. After the latching means, later described, is disengaged, the coke oven door, carried by the door extracting mechanism, is moved away from the opening 26 to permit the pusher mechanism to extract the coke charge from the chamber 26. The door extraction hook 36 has a pair of laterally extending fingers 44 and 46 which move upwardly therewith as the hook 36 engages the receiver 40.

On opposite sides of the opening 26 pairs of hook-like retaining members 48 and 50 are secured to and extend outwardly from the coke oven structure 52. Latching or locking bars 54 and 56, which are also referred to as transverse engaging means, are associated with the coke oven door and are arranged to engage the hooked portions of retaining members 48 and 50 to lock the coke oven

door 10 in a closed and sealed position. The latch mechanism associated with the latching bar 54 includes a pair of spaced horizontal levers 58 and 60, as illustrated in FIGURE 3, that are nonrotatably secured to a shaft 62 that is rotatably secured to a pair of supports 64 and 66. The supports 64 and 66 are arranged in spaced relation to each other and are rigidly secured to the coke oven door body portion 12 and rotatably support the shaft 62. Vertical levers 68 and 70 are nonrotatably secured at one end to the shaft 62 for rotation therewith. The levers 58, 60, 68 and 70 are preferably keyed to the shaft 62 for rotation therewith. The shaft 62, however, is freely rotatable in supports 64 and 66. A pair of inclined levers 72 and 74 are nonrotatably secured at one end to the end portion of respective vertical levers 68 and 70 by means of splined shaft 76. The inclined levers 72 and 74 are secured at their other end portion to the transverse locking or latching bar 54. The inclined levers 72 and 74 are preferably at an inclined angle of between 25° and 30° with the horizontal (FIGURE 1). Thus, the clockwise rotation of horizontal levers 58 and 60 rotates the locking bar 54 in a clockwise direction to release the locking bar 54 from the hook-like retaining member 48. There are secured to and extending forwardly from the coke oven door body portion 12 a pair of stops 80 and 82 which limit the clockwise rotation of the levers above discussed.

The lower locking bar 56 has a lever mechanism associated therewith which includes a pair of horizontal levers 84 and 86 which are nonrotatably connected to pins 88 and 90. A pair of vertical levers 92 and 94 are nonrotatably connected at their end to pins 88 and 90 so that rotation of levers 84 and 86 in a given direction is transmitted through the pins 88 and 90 to the levers 92 and 94. The pins 88 and 90 are rotatably supported in supports 96 and 98 which are, in turn, fixedly secured to the coke oven door body portion 12. Thus the pins 88 and 90 are free to rotate in the supports 96 and 98 and are nonrotatably connected to respective levers 84, 92 and 86, 94. Extending forwardly from and nonrotatably connected to the vertical levers 92 and 94 are a pair of inclined levers 100 and 102. The levers 100 and 102 are nonrotatably connected to the respective levers 92 and 94 by a splined connection to the shaft 104. The end portions of inclined levers 100 and 102 are secured to the transverse latching or locking bar 56. The levers 100 and 102 are inclined at an angle preferably between 25° and 30° to the horizontal.

The upper and lower lever mechanisms previously described are interconnected by a pair of vertical connecting rods 106 and 108. Each of the connecting rods 106 and 108 have clevis end portions 110 that rotatably connect the respective end portions to the upper and lower horizontal levers as, for example, the connecting rod 106 is connected by means of clevis connections 110 to the end portions of upper horizontal lever 58 and lower horizontal lever 84. The connecting rods 106 and 108 have sleeve portions 112 and 114 with fingers 116 and 118 extending laterally inwardly therefrom. The fingers 116 and 118 are arranged to be engaged by the fingers 44 and 46 associated with the door extracting hook 36. The vertical connecting rods 106 and 108 have threaded adjusting sleeves 120 and 122 which provide a means to adjust the length of connecting rods 106 and 108 and thereby adjust the angular relation or inclined angle of the inclined levers 72, 74, 100 and 102.

Operation

In removing the door 10 the door extracting mechanism 32 is moved into position and the door extracting hooks 36 and 38 are moved upwardly to engage the receivers 40 and 42. As the hooks 36 and 38 engage the receivers 40 and 42, the fingers 44 and 46 on extraction hook 36 engage the fingers 116, 118 on connecting rods 106 and 108. Further upward movement of the extraction hooks 36 and 38 lifts the door 10 from the stoop or frame 28 to automatically free the upper and lower locking bars 54 and 56 from the respective retaining members

48 and 50 and rotate the inclined levers 72 and 74 clockwise to clear the transverse locking bars 54 and 56 from the hooks 48 and 50. The door extracting mechanism 32 then moves the door from the opening 26.

In replacing the door the door extractor 32 moves the door horizontally into the opening 26 with the lower portion 20 spaced from the stoop 28. The locking bars 54 and 56 are in a position to clear the hooks 48 and 50. The extracting mechanism pushes the door horizontally until the sealing means 22 is seated in the door jamb 24. The door is then lowered until the portion 20 abuts the stoop 28 and the locking bars 54 and 56 pivot counterclockwise and engage the hooks 48 and 50, thus latching the door 10. With this arrangement, substantially the same force is exerted by both of the latching bars 54 and 56 on the hooks 48 and 50 so that there is a substantially uniform loading on each of the latching bars. If one of the latching bars 54 or 56 engages before the other, the connecting linkage through rods 106 and 108 would quickly pull the other locking bar into locking position to thereby enable both locking bars to be simultaneously engaged. As the weight is transferred from the extraction hooks 36 to the latching mechanism, both latching bars 54 and 56 through the lever arrangement previously described share the closure force. The previously described arrangement thereby provides a self-equalizing means between the respective pair of locking bars 54 and 56.

In addition to the above advantages, it is believed that the potential energy of the door in an elevated position is available to provide additional latching forces on the latching mechanism. As previously stated, the horizontal latching force is equal to the weight of the door times the cotangent of the angle of inclination of the inclined levers 74 and 102 connected to the transverse latching bars 54 and 56. Where, for example, the door weighs 8,000 lbs., the latching force exerted on the transverse latching bars is between 13,000 lbs. and 17,000 lbs. This horizontal latching force may be increased without increasing the weight of the door if the potential energy of the door in its elevated position is utilized. As an illustrative example, where the door is lowered two inches to seat the latching bars, the maximum potential energy, that is present in the door in its elevated position is equal to the distance—two inches—times the weight of the door—8,000 lbs.—and equals 1,333 ft. pounds. If the vertical velocity of the door, due to its lowering action, is arrested in one-fourth inch, then the vertical reaction force required to oppose the lowering action of the door is equal to about 64,000 pounds. This reaction force can be utilized as an additional latching force where desired. This additional latching force may be varied by selecting the proper door lowering velocity and the resilience of the latches.

Although the lever mechanisms are described as separate interconnecting lever portions, it should be understood the levers may be modified without departing from the invention. There have also been described pairs of lever mechanisms associated with pairs of connecting rods. It should be understood that the invention is not limited to the specific construction herein described and other lever arrangements may be utilized. Other structure may be included with the herein disclosed latching mechanism to provide spring type loadings on the latching bars where desired.

According to the provisions of the patent statutes, the principal, preferred construction, and mode of operation of the invention have been explained, and what is now considered to represent its best embodiment has been illustrated and described. However, it should be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. Apparatus for latching and unlatching a coke oven door having a body portion, a peripheral flange projecting outwardly therefrom, a seal means extending around

the periphery of said flange for abutting a sealing surface surrounding the opening for said door and sealing said coke oven chamber, said latching and unlatching apparatus comprising,

- (a) a pair of upper retaining members affixed to and projecting from the coke oven structure and positioned on opposite sides of said door opening, 5
- (b) a pair of lower retaining members affixed to and projecting from the coke oven structure and positioned on opposite sides of said door opening, 10
- (c) upper lever means pivotally connected to said door and extending outwardly therefrom,
- (d) lower lever means pivotally connected to said door and extending outwardly therefrom,
- (e) door extractor receiver means secured to said door and extending outwardly therefrom, 15
- (f) upper transverse engaging means secured to said upper lever means and arranged to be positioned in said upper retaining members to hold said door in sealing relation with said coke oven chamber, 20
- (g) lower transverse engaging means secured to said lever and arranged to be positioned in said lower retaining means and operable to hold said door in sealing relation with said coke oven chamber,
- (h) connecting means between said upper and lower lever means arranged to pivot both of said lever means so that upon engagement said transverse engaging means exert substantially the same engaging force on said retaining members, 25
- (i) door extractor means having door extractor arms, 30 and
- (j) actuator means associated with said connecting means, said actuator means arranged to be engaged by a portion of the door extractor arms upon upward movement of a portion of said arms into said door extractor receiver members to move said connecting means upwardly and disengage said upper and lower transverse engaging means from said respective retaining members to unlatch said coke oven door. 40

2. Apparatus for latching and unlatching a coke oven door as set forth in claim 1 in which said connecting means includes rod means pivotally connected to said upper lever means and said lower lever means, and said actuator means including laterally extending finger portions secured to said rod means intermediate said rod means end portions. 45

3. Apparatus for latching and unlatching a coke oven door as set forth in claim 1 in which said connecting means includes rod means pivotally connected to said upper lever means and said lower lever means, said rod means including adjusting means to adjust the length of said rod means. 50

4. Apparatus for latching and unlatching a coke oven door having a body portion, a peripheral flange projecting outwardly therefrom, a seal means extending around the periphery of said flange for abutting a sealing surface surrounding the opening of said door and sealing said coke oven chamber, said latching and unlatching apparatus comprising, 60

- (a) a pair of upper retaining members affixed to and projecting from said coke oven structure and positioned on opposite sides of said door opening, said upper retaining members having hook-shaped end portions, 65
- (b) a pair of lower retaining members affixed to and projecting from the coke oven structure end portion on opposite sides of said door opening, said lower retaining members having hook-shaped end portions,
- (c) upper lever means pivotally connected to said door and extending outwardly therefrom and including, 70
 - a horizontal portion,
 - a vertical intermediate portion extending upwardly from an end of said horizontal portion, and 75

- an end portion extending downwardly from the opposite end of said vertical portion and forming an acute angle with said vertical portion,
- (d) lower lever means pivotally connected to said door and extending outwardly therefrom and including, a horizontal portion,

a vertical intermediate portion extending downwardly from an end of said horizontal portion, and

an inclined portion extending downwardly from the other end of said vertical portion and forming an obtuse angle with said vertical portion,

(e) door extractor receiver means secured to said door between said upper and lower lever means and extending outwardly therefrom,

(f) upper transverse engaging means connected to said upper lever inclined portion in spaced relation to said upper lever vertical portion, said upper transverse engaging means arranged to be positioned in said upper retaining members to hold said door in sealing relation with said coke oven chamber,

(g) lower transverse engaging means connected to said lower lever inclined portion in spaced relation to said lower lever vertical portion, said lower transverse engaging means arranged to be positioned in said lower retaining means and operable to hold said door in sealing relation with said coke oven chamber,

(h) connecting means between said upper and lower levers including rod means pivotally connected to said upper lever means and said lower lever means, said rod means arranged to pivot both of said lever means so that upon engagement said transverse engaging means exert substantially the same engaging force on said retainer members,

(i) actuator means extending laterally from said rod means intermediate said rod means end portions, said actuator means arranged to engage a portion of the door extractor arms upon upward movement of a portion of said arms into said door extractor receiver members to move said rod means upwardly and disengage said upper and lower transverse engaging means from said respective retaining members to unlatch said coke oven door, and

(j) adjustment means arranged to adjust the length of said rod means and thereby adjust the angular relation of said upper and lower lever inclined portions.

5. Apparatus for latching and unlatching a coke oven door having a body portion, a peripheral flange projecting outwardly therefrom, seal means extending around the periphery of said flange for abutting a sealing surface surrounding the opening from said door and sealing said coke oven chamber, said latching and unlatching apparatus comprising,

(a) a pair of upper retaining members affixed to and projecting from the coke oven structure and positioned on opposite sides of said door opening,

(b) a pair of lower retaining members affixed to and projecting from the coke oven structure and positioned on opposite sides of said door opening,

(c) upper lever means pivotally connected to said door and extending outwardly therefrom, said upper lever means including a horizontal portion, a vertical intermediate portion extending upwardly from an end of said horizontal portion and an inclined portion extending downwardly from the opposite end of said vertical portion and forming an acute angle with said vertical portion,

(d) lower lever means pivotally connected to said door and extending outwardly therefrom,

(e) upper transverse engaging means connected to said upper lever means inclined portion in spaced relation to said upper lever means vertical intermediate portion, said upper transverse engaging means arranged to be positioned in said upper retaining members to

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position said door in sealing relation with said coke oven chamber,

- (f) lower transverse engaging means secured to said lever and arranged to be positioned in said lower retaining means and operable to position said door in sealing relation with said coke oven chamber, and
 (g) connecting means between said upper and lower lever means arranged to pivot both of said lever means simultaneously so that upon engagement said transverse engaging means exerts substantially the same engaging force on said retaining members.

6. Apparatus for latching and unlatching a coke oven door as set forth in claim 5 in which said upper lever means is pivotally connected to said door at a location adjacent the junction of said horizontal portion and said vertical portion, and said connecting means connected to said upper lever horizontal portion in spaced relation to said upper lever pivot connection.

7. Apparatus for latching and unlatching a coke oven door having a body portion, a peripheral flange projecting outwardly therefrom, seal means extending around the periphery of said flange for abutting a sealing surface surrounding the opening for said door and sealing said coke oven chamber, said latching and unlatching apparatus comprising,

- (a) a pair of upper retaining members affixed to and projecting from the coke oven structure and positioned on opposite sides of said door opening,
 (b) a pair of lower retaining members affixed to and projecting from the coke oven structure and positioned on opposite sides of said door opening,
 (c) upper lever means pivotally connected to said door and extending outwardly therefrom,
 (d) lower lever means pivotally connected to said door and extending outwardly therefrom, said lower lever means including a horizontal portion, a vertical intermediate portion extending downwardly from an end of said horizontal portion and an inclined portion extending downwardly from the other end of said

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vertical portion and forming an obtuse angle with said vertical portion,

- (e) upper transverse engaging means secured to said upper lever means and arranged to be positioned in said upper retaining members to position said door in sealing relation with said coke oven chamber,

- (f) lower transverse engaging means connected to said inclined portion of said lower lever means in spaced relation to said lower lever means vertical portion, said lower transverse engaging means arranged to be positioned in said lower retaining means and operable to position said door in sealing relation with said coke oven chamber, and

- (g) connecting means between said upper and lower lever means arranged to pivot both of said lever means simultaneously so that upon engagement said transverse engaging means exerts substantially the same engaging force on said retaining members.

8. Apparatus for latching and unlatching a coke oven door as set forth in claim 7 in which said lower lever is pivotally connected at the junction of said vertical and horizontal portions to said door, said connecting means connected to said horizontal arm in spaced relation to said pivot connection.

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EDWARD C. ALLEN, *Primary Examiner.*

RICHARD E. MOORE, *Examiner.*

J. R. MOSES, *Assistant Examiner.*