

Aug. 23, 1932.

J. VAN ACKEREN

1,873,076

SELF SEALING DOOR FOR COKE OVENS

Filed June 14, 1927

6 Sheets-Sheet 1

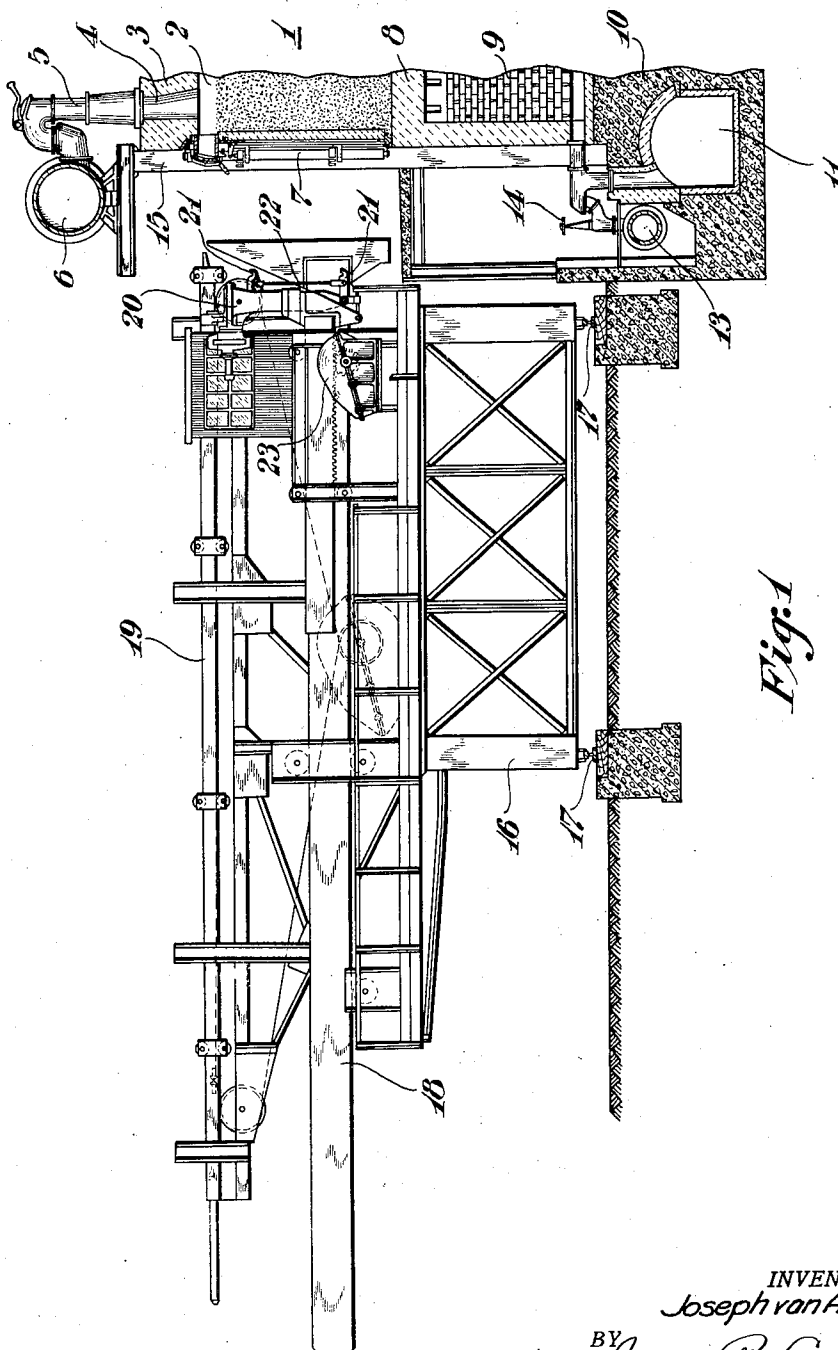


Fig. 1

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6 Sheets-Sheet 2

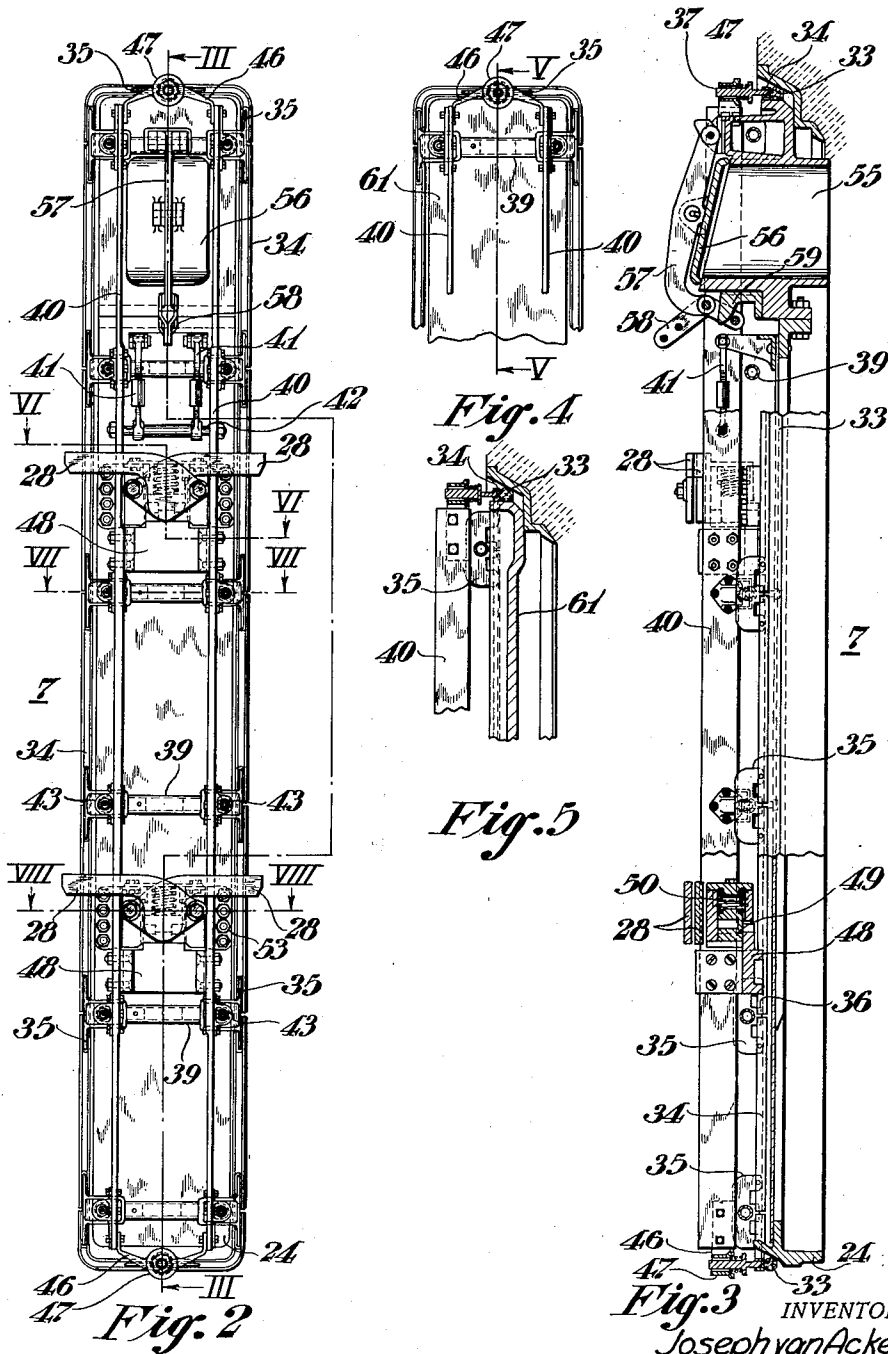


Fig. 3
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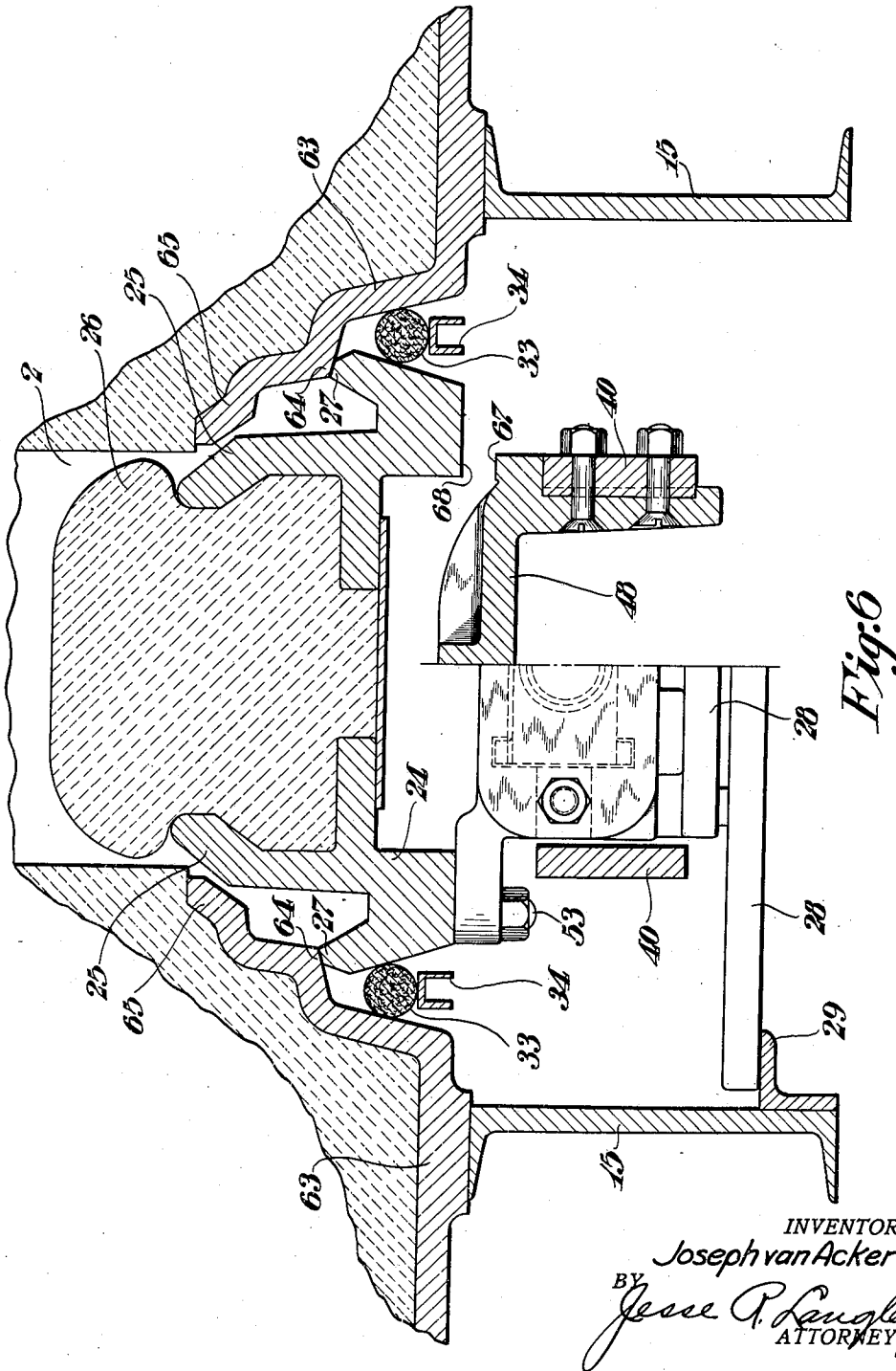
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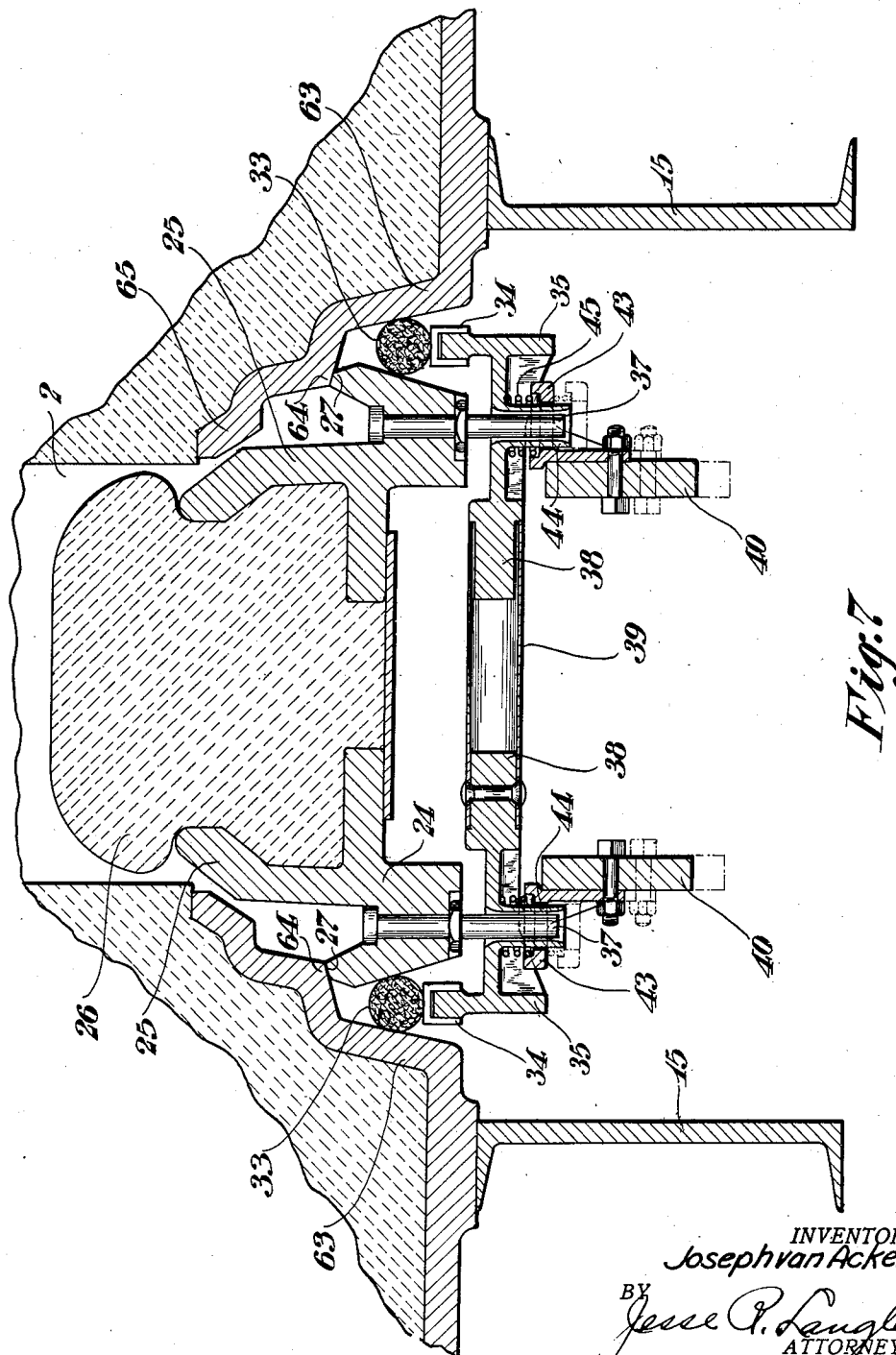
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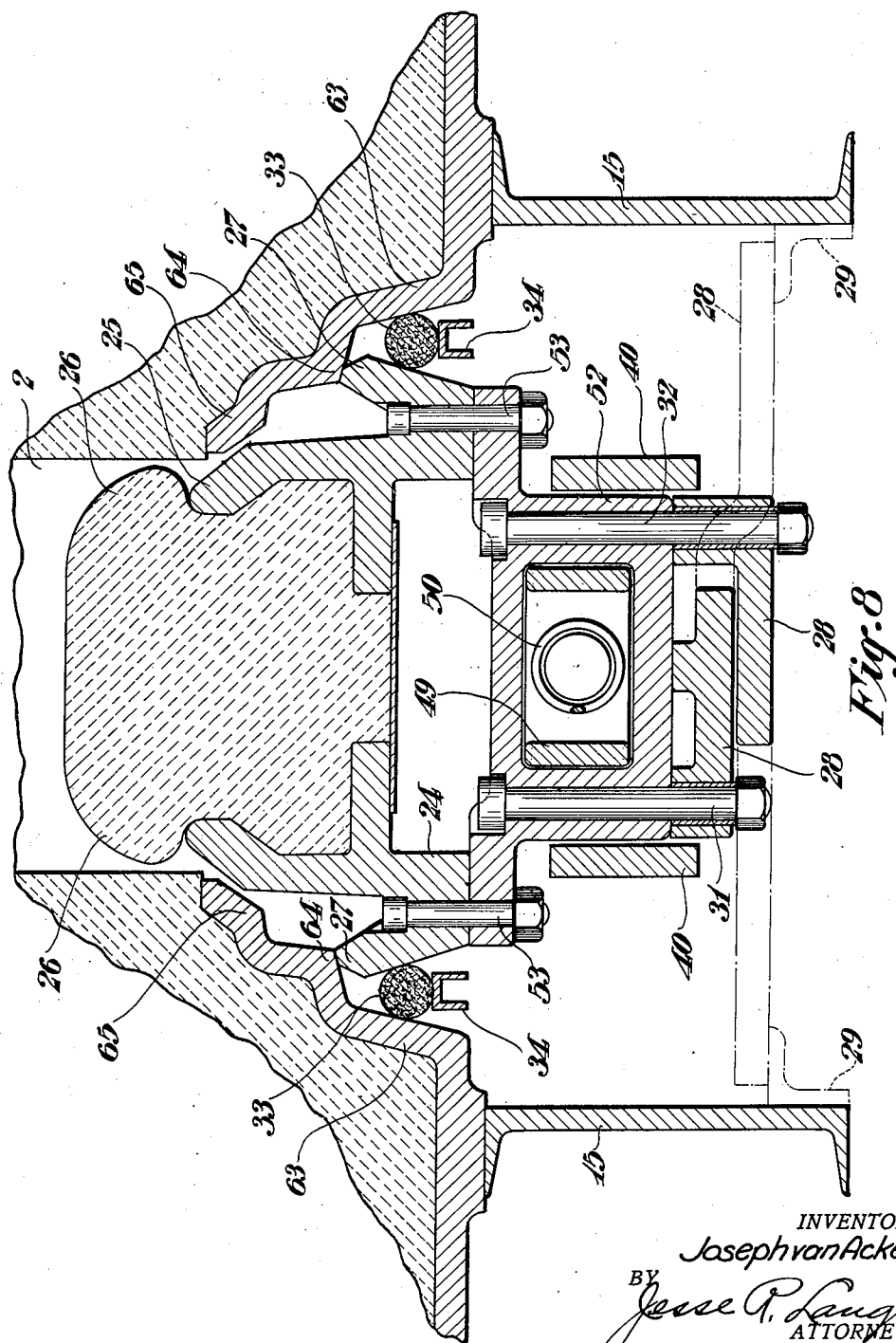


Fig. 8

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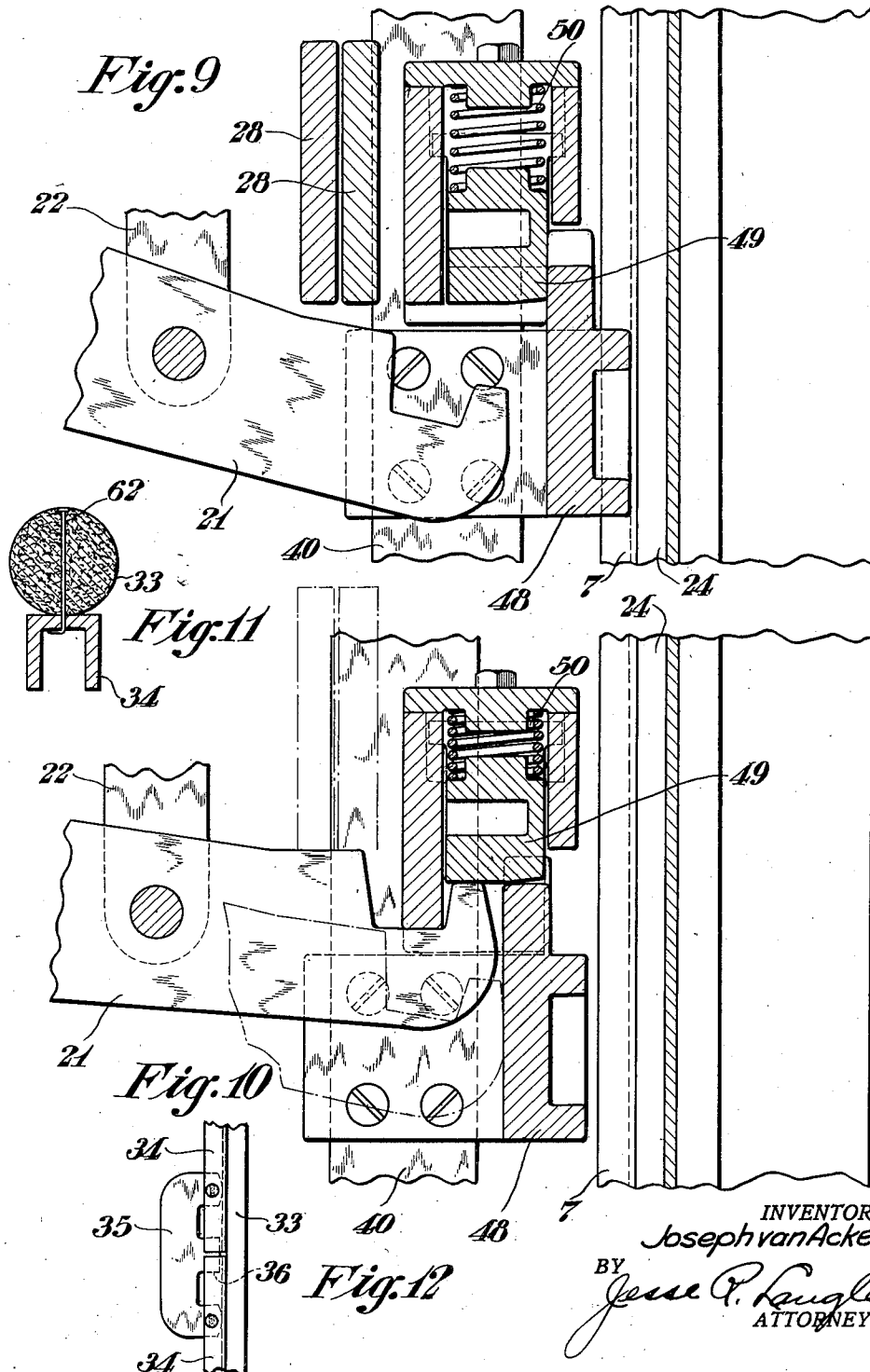
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SELF SEALING DOOR FOR COKE OVENS

Filed June 14, 1927

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

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SELF-SEALING DOOR FOR COKE OVENS

Application filed June 14, 1927. Serial No. 198,770.

My invention relates to doors for coke ovens and particularly to doors of the automatic self-sealing type for horizontal and inclined coke ovens.

One object of my invention is to provide a door for coke ovens that operates automatically when placed in operative position to seal the associated opening.

Another object of my invention is to provide a coke-oven door in connection with which there is no necessity for luting or for the employment of means other than that comprised in or carried by the door structure.

A further object of my invention is to provide a door having means which operates to yieldingly engage the coacting oven surfaces whereby sealing engagement may be effected therebetween when the coacting surfaces do not closely conform to each other.

A further object of my invention is to provide a coke-oven door which operates automatically to lock itself in closed sealing position or to be released from said locked position, as the case may be, when the usual door machine or door-extracting mechanism is correspondingly manipulated.

A still further object of my invention is to provide a coke-oven door that may be placed in position and locked in sealing engagement with the coke oven and removed from the coke oven by the ordinary movement of the usual door-extracting mechanism whereby no manual operations of the door mechanism are required.

In accordance with my invention, I provide a coke-oven door, the main body portion of which is provided with peripheral sealing means that is adapted to engage adjacent surfaces of the door and the oven structure. Pressure from an external source is transmitted substantially equally to all parts of the sealing means whereby irregularities in the surfaces do not affect the efficiency of the seal.

The door is so arranged that it may be placed in position in the opening of the oven, secured to the stationary structure of the battery and the seal adjusted and latched in position with a simple movement of the usual door-extracting mechanism. The lifting

movement of the arms of the door-extracting mechanism is sufficient to release the sealing means to unfasten the means for securing the door to the battery structure and to remove the door from the oven as in previous practice. The improved coke-oven door of my invention requires no manual operation in securing it in place or in removing it from the coke oven.

My invention will now be described in connection with the accompanying drawings, in which similar numerals designate corresponding parts.

Figure 1 is a view, partially in transverse section and partially in elevation, of a portion of a coke-oven battery and an associated pusher machine provided with door-extracting mechanism;

Fig. 2 is a view in front elevation of a coke-oven door for the pusher side of the battery and constructed in accordance with my invention;

Fig. 3 is a view, partially in longitudinal section, on line III—III, and partially in side elevation, of the door of Fig. 2;

Fig. 4 is a view, in front elevation, of a portion of a coke-oven door for the coke side of the battery;

Fig. 5 is a view in longitudinal section on line V—V of the structure of Fig. 4;

Fig. 6 is a view, in broken section, taken on line VI—VI of Fig. 2;

Fig. 7 is a view in transverse section taken on line VII—VII of Fig. 2;

Fig. 8 is a similar view, taken on line VIII—VIII of Fig. 2;

Fig. 9 is an enlarged view in longitudinal section of a portion of the door of Fig. 2, illustrating a latching mechanism for the sealing means and a coacting arm of the door-extracting mechanism, the latch being in closed position;

Fig. 10 is a view, similar to Fig. 9, the latch being in open position;

Fig. 11 is an enlarged sectional view, illustrating the manner in which the sealing device is secured to the controlling means therefor; and

Fig. 12 is an enlarged elevational view of a

portion of the equalizing means for applying pressure to the sealing device.

Referring particularly to Fig. 1, a coke-oven battery 1 only a portion of which is shown, comprises a series of oven chambers 2, each having a top 3 that is provided with one or more off-take openings 4. An ascension pipe 5 connects the off-take opening 4 to a collecting main 6. The end of the oven chamber 2 is provided with a removable door 7 that is adapted to close the end opening of the oven in a gas-tight manner in accordance with the requirements of coke-oven practice.

Each oven chamber 2 is provided with a floor 8, beneath which may be located a regenerator 9. Within the foundation 10 is located a flue 11 for waste gases. A gas main 13, having suitable valves 14, supplies fuel to the battery. The side walls of the battery are reinforced by the usual buckstays 15.

A pushed machine 16, which operates on rails 17 that are parallel to the battery, is provided with the usual pusher ram 18 and leveler bar 19. The pusher machine 16 is also provided with a door-extracting mechanism 20, having two movable arms 21 that are provided with hooks at their outer ends for purposes hereinafter set forth. The arms 21 are connected by a link 22 for equal and simultaneous movements. The door mechanism is operated by means of a power device 23 that is geared thereto in any suitable or usual manner.

Reference may now be had to Figs. 2, 3 and 6 to 12, inclusive, in which the details of the coke-oven door of my invention are shown. The door 7, which is of the plug type, has a main body portion comprising a frame 24, which may be of cast iron or other suitable material. The frame 24, which is elongated and adapted to close the end opening of a horizontal or inclined coke oven, is provided on its inner side with flanges 25, which are adapted to retain silica brick or other suitable refractory material to constitute an interior lining 26 for the door. The frame 24 is also provided with a peripheral flange 27 for engaging a suitable coacting portion of the oven structure as will be hereinafter described.

The door 7 is provided with two pairs of pivotally-mounted arms 28 that are adapted to engage angle bars 29 that are secured to buckstays 15 on either side of the coke oven. The arms 28 of each pair overlap each other and are pivotally mounted on pins 31 and 32 for movement in vertical planes. The pins 31 and 32 are spaced apart whereby the arms 28 may be actuated by a member that is vertically movable between the pivot pins.

The door 7 is also provided with means for sealing its connection to the oven structure, the sealing means being carried by the door and being operated by mechanism connected thereto. The sealing means comprises a sub-

stantially continuous rope 33 of asbestos or other suitable material that extends around the door adjacent to the flange 27. The rope 33 is connected to a series of channel members 34 that extend end-to-end throughout the length of the rope 33 and constitute a pressure frame therefor. As best shown in Fig. 12, the channel members 34 are connected at their ends by means of bridging members 35 having a pivotal connection thereto and having also a projection 36 that is adapted to engage the abutting extreme end portions of the channel members. This arrangement insures that the pressure frame is flexible.

As best shown in Fig. 7, the bridging members 35 on the sides of the door are located in oppositely disposed pairs and are each mounted on a guide pin 37 that is secured to the frame 24. The bridging members 35 are also provided with rods 38 that extend transversely toward each other and are connected by a hollow sleeve 39. The sleeve 39 is fixed to one of the rods 38 and is freely movable with respect to the other rod. This arrangement maintains the parallel relation of the bridging members 35 and relieves the guide pins 37 of any considerable strains that might be caused during the operation of the mechanism.

The actuating means for the bridging members 35 comprises two bars 40 that extend vertically substantially throughout the length of the door 7 and are suspended therefrom for movement relatively thereto by two pivotally mounted arms 41 that are pivotally connected to a cross-bar 42. The bars 40, which extend adjacent to the several guide pins 37 for the bridging members 35, are provided with annular members 43 that surround a flange 44 of the bridging member 35 and the guide pins 37. A spring 45 also surrounds the flange 44 and normally spaces the bridging member 35 from the annular member 43 and provides a yielding connection therebetween.

The portions of the flexible sealing rope 33 across the ends of the door 7 are each controlled by a bridging member 35 that is operatively connected to the bars 40 by means of a yoke 46 having an annular portion 47 for applying pressure to a spring 45. A guide pin 37 is provided and the connections to the end bridging members 35 are similar. Those already described for the side bridging members.

The bars 40 are rigidly connected to each other adjacent to the pairs of arms 28 by plates 48. Between the bars 40 and adjacent to each of the two plate members 48 is a latching mechanism comprising a vertically movable member 49 that is actuated by a spring 50 to engage the corresponding plate member 48 and to retain the latter when it has been actuated to its innermost position, as illustrated in Fig. 9. As best shown in Fig. 8, the

latch mechanism is contained in a casting 52 that is rectangular in transverse cross-section and is secured to the body 24 of the door by bolts 53.

As shown in Figs. 2 and 3, the door 7, which is adapted for the pusher side of the battery, is provided with a leveling door 55 that is located between the two bars 40. The closure member 56 of the door is pivotally connected to a bar 57 that is hinged at its upper end and is provided at its lower end with a latching device 58 that is adapted to engage a tapered lug 59. As shown in Fig. 3, the leveling door 55 is closed. In order to open it, it is only necessary to lift the handle of the latching mechanism 58 whereupon it is disengaged from the lug 59 and the door may be readily opened and retained in that position by any usual or suitable means. In closing the door, it is only necessary to let it fall by gravity and to turn the latching mechanism 58 into its illustrated position to securely fasten the door.

Reference may now be had to Figs. 4 and 5, in which the upper portion of a door 61 for the coke side of the battery is illustrated. The structure of this door differs in no essential particular from the door of Figs. 2 and 3, except that the leveling door is omitted. The sealing mechanism is identical with that previously described and a detailed description thereof is, accordingly, unnecessary.

A preferred manner of fastening the sealing rope 33 to the channel members 34 which constitute the pressure frame is illustrated in Fig. 11. A wire nail 62, or other suitable metallic device, is driven through the center of the asbestos rope 33 and through an opening in the bottom of the channel 34, the inner end of the nail 62 being bent or clinched in order to firmly secure it in position. When the rope is fastened in the manner above described, the sides thereof are free to adapt themselves to coacting surfaces in order to make sealing engagement therewith.

As shown in Figs. 6, 7 and 8, the end opening of the oven chamber 2 is cut away at the corners thereof and the silica brick or refractory material of the battery walls is covered with a casting 63 of somewhat corrugated shape to provide a succession of shoulders from the outer surface of the wall across the cut-away portions of the walls of the oven chamber 2.

The flange 27 of the door 7 engages the first of these shoulders 64 to limit the inward movement of the door when the latter is placed in position. A recess of substantially wedge shape is provided between the casting 63 and the flange 27 around the entire periphery of the door. The flange 25, which retains the heat-insulating lining of the door, is closely adjacent to a second should-

der 65 of the casting 63 in order to substantially close the oven by these parts.

It may be assumed that the end of the oven chamber 2 in Fig. 1 is open and that it is desired to place a door constructed in accordance with my invention in position to seal the opening. It may be assumed further that the door to be placed in position is supported upon the hook-like portions of the movable arms 21 of the door-extracting mechanism.

In this position of the door, the arms 21 engage the latching mechanism, as illustrated in Fig. 10, and the arms 28 are actuated about their respective pivot pins 31 and 32 to such position that they are out of alignment with the buckstays 15 and the angle bars 29. The door-extracting mechanism is then advanced toward the coke oven until the door is in substantially the position in which it is illustrated in Figs. 6, 7 and 8, with the flange 27 in engagement with the coacting shoulder 64. The weight of the door is now supported by the oven structure and the arms 21 of the door-extracting mechanism may be lowered to permit the arms 28 to assume a horizontal position to engage the angle bars 29, as shown in Fig. 6.

The arms 21 now occupy a position similar to that shown in Fig. 9, but the parts of the latching mechanism occupy the relative positions in which they are shown in Fig. 10. The door-extracting mechanism is then actuated toward the door, whereupon the arms 21 engage the plates 48, which connect the vertical bars 40 and the latter are caused to compress the several springs 45 that bear on the bridging members 35 which are caused to force the frame 34 and the connected sealing rope 33 into the wedge-shaped recess around the door 7. When the bars 40 and the connecting plates 48 have been actuated to a predetermined distance, the latches 49 will be actuated downwardly by their corresponding springs 50 in front of the respective plates 48 to retain the sealing mechanism in its adjusted position with respect to the frame 24 of the door. The door-extracting mechanism may now be removed and the door will remain in position with the sealing mechanism in position to seal the adjacent surfaces of the oven and the door in a gas-tight manner.

By reason of the flexible nature of the sealing rope and the jointed construction of the frame constituted by the channel members 34 and the application of pressure at a plurality of points, the sealing means is effective to adjust itself to the adjacent surfaces, even though they may be warped or otherwise deformed or there may be a certain amount of foreign material thereon, any of which conditions might otherwise destroy the effectiveness of the seal if rigid sealing means were employed. The arrangement whereby springs

are employed and are maintained under considerable pressure while the door is in operative position insures that a definite pressure is maintained at all times upon substantially every portion of the sealing rope.

Means are provided whereby the destruction or deformation of the springs in operating the sealing means is avoided. As shown in Fig. 6, each of the plates 48 is provided at each end with a shoulder portion 67 which engages a shoulder 68 of the door when the springs 45 have been compressed to a predetermined maximum degree. The distance between the shoulders 67 and 68 is such as to permit the latching of the sealing means in position, but limits the force that may be applied to the springs in case the door-extracting mechanism is operated with greater force than is necessary.

When it is desired to remove a door 7 from its corresponding oven chamber 2, the door-extracting mechanism is operated in a manner opposite to that previously described. The arms 21 are placed in positions corresponding to that shown in Fig. 9 and are then actuated upwardly to release the latch member 49 and to simultaneously therewith raise the arms 28 to unlock the door from the buckstays 15. The arms 21 and the coacting parts then occupy the relative positions shown in Fig. 10. It is then only necessary to withdraw the door-extracting mechanism to remove the door 7 from the oven.

It will be noted that the coke-oven door of my invention possesses a number of decided advantages. The door may be placed in position, secured to the battery structure, and the sealing mechanism placed in position entirely without any manual manipulation of the door mechanism, including the sealing means. The mechanism for locking the door to the oven structure and the latch mechanism for the sealing means operate entirely automatically in connection with the operation of the door-extracting mechanism.

The automatic self-sealing doors may be quickly placed in position and withdrawn therefrom and there is no loss of time, as in connection with the coke-oven doors in present use, since my improved coke-oven doors require no luting or other sealing means, the door being entirely self-contained.

An important advantage of the improved doors is that they may be adapted to existing ovens with only slight modifications of the battery structure and with substantially no change in the operating mechanism therefor, since the doors are adapted to be handled entirely by the usual and ordinary door-extracting mechanisms.

The foregoing and other advantages will be apparent to those skilled in the art relating to coke-oven construction and operation. It is obvious that modifications of my invention will occur to others and it is not de-

sired to limit my invention, therefore, except as expressed in the appended claims.

I claim as my invention:

1. The combination with a coke-oven structure having an opening therein, of a door for closing said opening and comprising a main body portion, means for securing said main body portion to said structure, means for making sealing engagement with said oven structure, said door being adapted to be operated by unitary means for placing said door in operative position, effecting the positioning of said securing means and positioning said sealing means.

2. The combination with a coke-oven structure having an opening therein, of a door for closing said opening and comprising a main body portion, means for securing said main body portion to said structure, means for making sealing engagement with said oven structure, said door being adapted to be operated by unitary means for placing said door in operative position, effecting the positioning of said securing means and then positioning said sealing means, said unitary means comprising a door-extracting mechanism.

3. The combination with coke-oven structure having an opening therein, of a door for closing said opening and comprising a main body portion, means for securing said main body portion to said structure, and means for making sealing engagement with said oven structure, said door being adapted to be operated by unitary means for successively releasing said sealing means and said securing means and then removing said door from said opening.

4. The combination with a coke-oven structure having an opening therein, of a door for closing said opening and comprising a main body portion, means for securing said main body portion to said structure, and means for making sealing engagement with said oven structure, said door being adapted to be operated by unitary means for successively releasing said sealing means and said securing means and then removing said door from said opening, said unitary means comprising a door-extracting mechanism.

5. A door for coke ovens comprising a main body portion, sealing means carried thereby and movable relatively thereto while the door is stationary in its closed position, means for latching said sealing means in sealing position on said body portion, and means for securing said body portion in operative position with respect to an end opening of a coke oven closed thereby.

6. A door for coke ovens comprising a main body portion, sealing means carried thereby and movable relatively thereto, means for latching said sealing means in sealing position on said body portion, and means for securing said body portion in op-

erative position with respect to an opening closed thereby, said door being adapted to be operated by means movable in a single direction for releasing said latching means and said securing means successively.

7. The combination with a coke-oven door having arms movable in a vertical plane for securing said door in closed position and having also sealing means carried thereby and movable relatively thereto into and out of sealing position while the door is stationary in its closed position, a movable latch member on said door for locking said sealing means in sealing position, of a door-extracting mechanism having movable members which, when moved upwardly while the door is closed in sealing position, disengage said latch member, move said arms to inoperative positions and support the weight of said door.

8. The combination with a coke-oven door having arms movable in a vertical plane for securing said door in position and having also sealing means carried thereby, a movable latch member on said door for locking said sealing means in sealing position, of a door-extracting mechanism having movable members which, when moved downwardly after the door has been placed in closed position by said members, permit the weight of the door to be supported by adjacent structure and said arms to move to operative position and, when said members are moved toward said door, actuate said sealing means to operative position and permit the operation of said latch member to lock the sealing means in such position.

9. The combination with a horizontal coke-oven structure having an end opening with inclined outer edges, of a door for said opening having peripheral portions adjacent to said inclined edges and inclined oppositely with respect thereto to provide a flaring recess therebetween, said door having sealing means movable relatively thereto into and out of sealing position while the door is stationary in its closed position, yielding means for causing said sealing means to engage the sides of said recess, and means relatively movable with respect to said door for actuating said yielding means.

10. The combination with a horizontal coke-oven structure having an end opening with inclined outer edges, of a door for said opening having peripheral portions adjacent to said inclined edges and inclined oppositely with respect thereto to provide a flaring recess therebetween, said door having movable sealing means for yieldingly engaging the sides of said recess, and means for automatically securing said sealing means in operative position upon being actuated thereto.

11. A coke-oven door comprising a main body portion, movable peripheral sealing means carried thereby, movable members

yieldingly connected to said sealing means for applying substantially equal pressures to all parts thereof, and automatically-operable means mounted on said door for retaining said movable members in pressure-applying positions.

12. The combination with a coke-oven structure having an opening therein, of a door for said opening having means for engaging adjacent surfaces of said structure and said door to constitute a seal for said opening, and means comprising a rigid frame movably mounted on said door and a flexible frame yieldingly connected to said rigid frame whereby pressure may be yieldingly applied to substantially all portions of said engaging means.

13. The combination with a coke-oven structure having an opening therein, of a door for said opening having means for engaging adjacent surfaces of said structure and said door to constitute a seal for said opening, means for latching said engaging means in sealing position, and means for exerting pressure on said engaging means to successively place it in operative position and latch it in such position.

14. The combination with a coke-oven structure having an opening therein, of a door for said opening having means for engaging adjacent surfaces of said structure and said door to constitute a seal for said opening, means for latching said engaging means in sealing position, and means comprising equalizing devices for yieldingly transmitting force to said engaging means, said latching means being operative when a predetermined force is applied to said transmitting means.

15. A coke-oven door comprising a main body portion having a peripheral flanged portion, a flexible member adjacent to said flanged portion, a plurality of relatively movable members for supporting said flexible member, means comprising equalizing devices and springs for yieldingly applying pressure to said supporting members and means mounted on said door for retaining said pressure-applying means in position with respect to said door to maintain pressure on said flexible member and thereby to seal the connection of said door to adjacent structure.

16. A coke-oven door comprising a main body portion and securing means for said body portion comprising a plurality of pairs of arms for coacting with coke-oven structure to secure the door in operative position, the arms of each pair overlapping and having spaced pivotal supports for movement in a vertical plane.

17. The combination with coke-oven structure comprising an oven chamber having an opening and a member on each of two opposite sides of said opening, of a door for

said opening having pivotally mounted arms for engaging said members to retain the door in operative position, and means for supporting said door adjacent the pivots of said arms whereby the arms are held in in-operative position when the door is supported by said means.

18. The combination with a coke-oven structure comprising buck-stays and an oven chamber having an end opening between two buck-stays, of a door for said opening having pairs of arms adapted to swing in a vertical plane into and out of engagement with said buck-stays, the arms of each pair overlapping and having spaced pivotal supports, and a door-extracting mechanism having movable members for placing said door into and out of operative position and for engaging the arms between their pivotal supports to control their position.

19. A coke-oven door comprising a main body portion, sealing means carried thereby and movable relatively thereto into and out of sealing position while the door is stationary in its closed position, and means movable while said body portion is stationary for yieldingly applying pressure to said sealing means and having limited movement relatively thereto, the movable means being adapted to engage said body portion at the end of said limited relative movement in applying pressure to said sealing means.

20. A coke-oven door comprising a main body portion, a sealing member therefor, a plurality of members secured to said sealing member, parallel members for bridging the adjacent ends of said plurality of members, and means for maintaining the parallel positions of said bridging members while permitting relative movement, said means comprising members for connecting opposite bridging members and having a swivel connection to permit relative angular movement of said bridging members.

21. In a coke-oven door that automatically seals upon closing, the combination with a main body portion comprising a frame adapted to engage a casing, of a substantially continuous flexible seal around said frame adapted to be pressed into engagement with said frame and with said casing and means for transmitting pressure to said seal comprising a rigid frame movably mounted on the door frame, a flexible frame connected to said seal, and spaced springs between said rigid frame and said flexible frame.

22. In a coke-oven door that automatically seals upon closing, the combination with a main body portion comprising a frame adapted to engage a casing, of a substantially continuous flexible seal around said frame adapted to be pressed into engagement with said frame and with said casing and means for transmitting pressure to said seal comprising a rigid frame movably mounted on the

door frame, a flexible frame connected to said seal and yieldingly connected to said rigid frame at a plurality of points, and means for retaining said rigid frame in position to yieldingly apply pressure to said seal.

23. In a coke-oven door that automatically seals upon closing, the combination with a main body portion comprising a frame, flexible sealing means extending around said frame, and operating means for said sealing means comprising a rigid frame that is movable with respect to said main body portion, a flexible frame directly connected to said sealing means, and a plurality of springs and members connected to said flexible frame for transmitting pressure from said rigid frame to said flexible frame.

24. The combination with a coke-oven door frame, of flexible sealing means extending around said frame, a flexible frame for carrying said sealing means, parallel members connected to said flexible frame at oppositely disposed points for transmitting pressure thereto, means for connecting said members for relative movement while maintaining their parallel relation in one plane, and means for yieldingly applying pressure to said members.

25. In a coke-oven door that automatically seals upon closing, in combination, a plug door constituted of a metal frame having a refractory body lining mounted therein, a substantially continuous compressible seal surrounding said door frame and adapted to be compressed into wedging engagement with the periphery of said door frame and the surrounding doorway, a flexibly jointed framework of rigid members carrying said seal and itself movably supported on said door frame, a rigid framework superposed outside of said flexible framework and movably supported on said door frame and adapted to receive applied pressure, a plurality of mutually spaced yielding pressure-transmitting elements interposed between said rigid framework and the aforesaid rigid members of the flexible framework, means for holding said rigid framework locked in the position to which the applied pressure forces it, and means adapting the door frame to be secured to and released from the oven structure by the same apparatus that applies pressure to and releases the aforesaid rigid framework of the sealing mechanism.

In testimony whereof, I have hereunto subscribed my name this 13th day of June, 1927.

JOSEPH VAN ACKEREN.