

May 1, 1962

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3,032,483

COKE OVEN DOORS

Filed Oct. 5, 1955

3 Sheets-Sheet 1

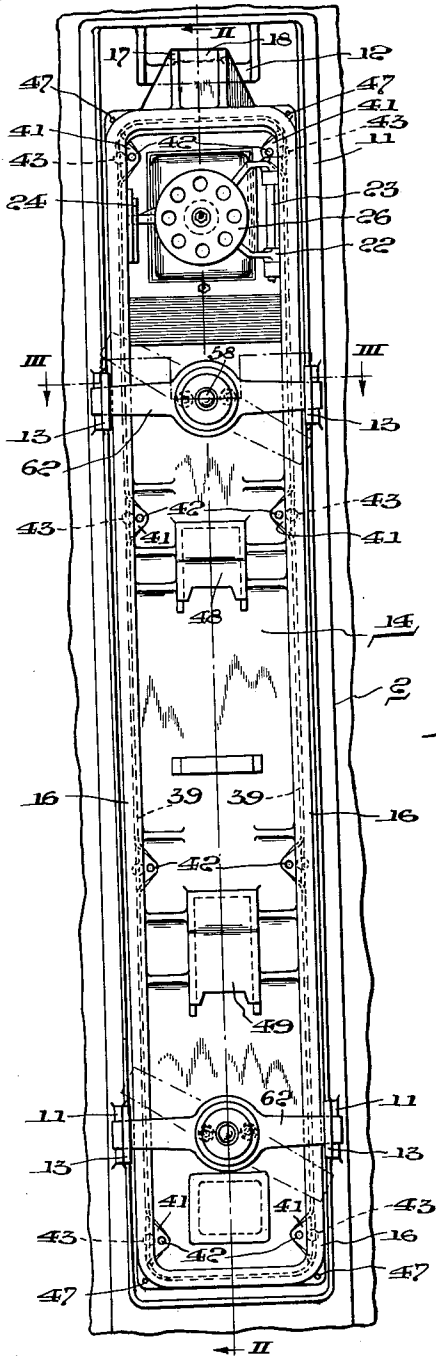


Fig. 1.

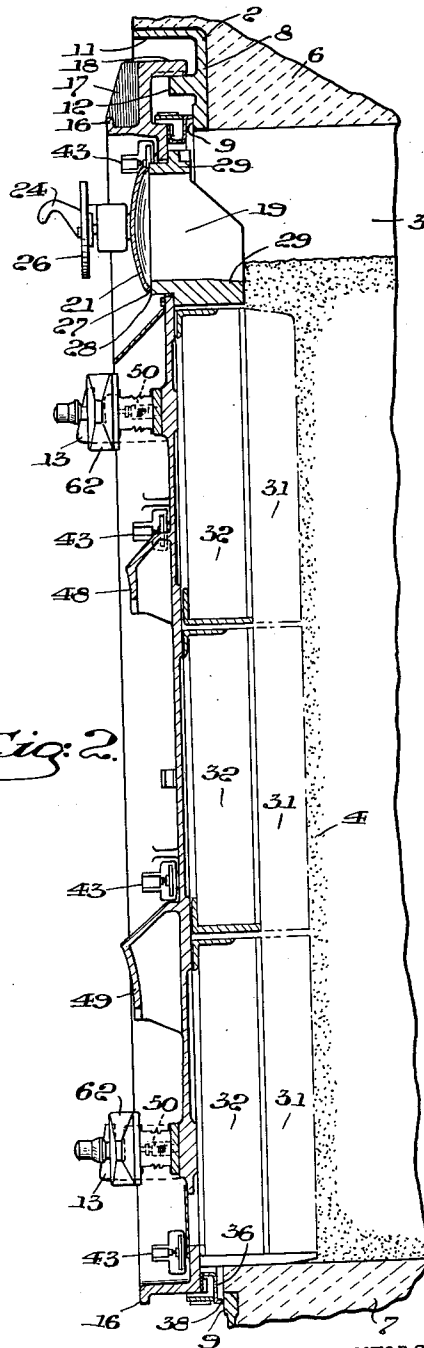


Fig. 2.

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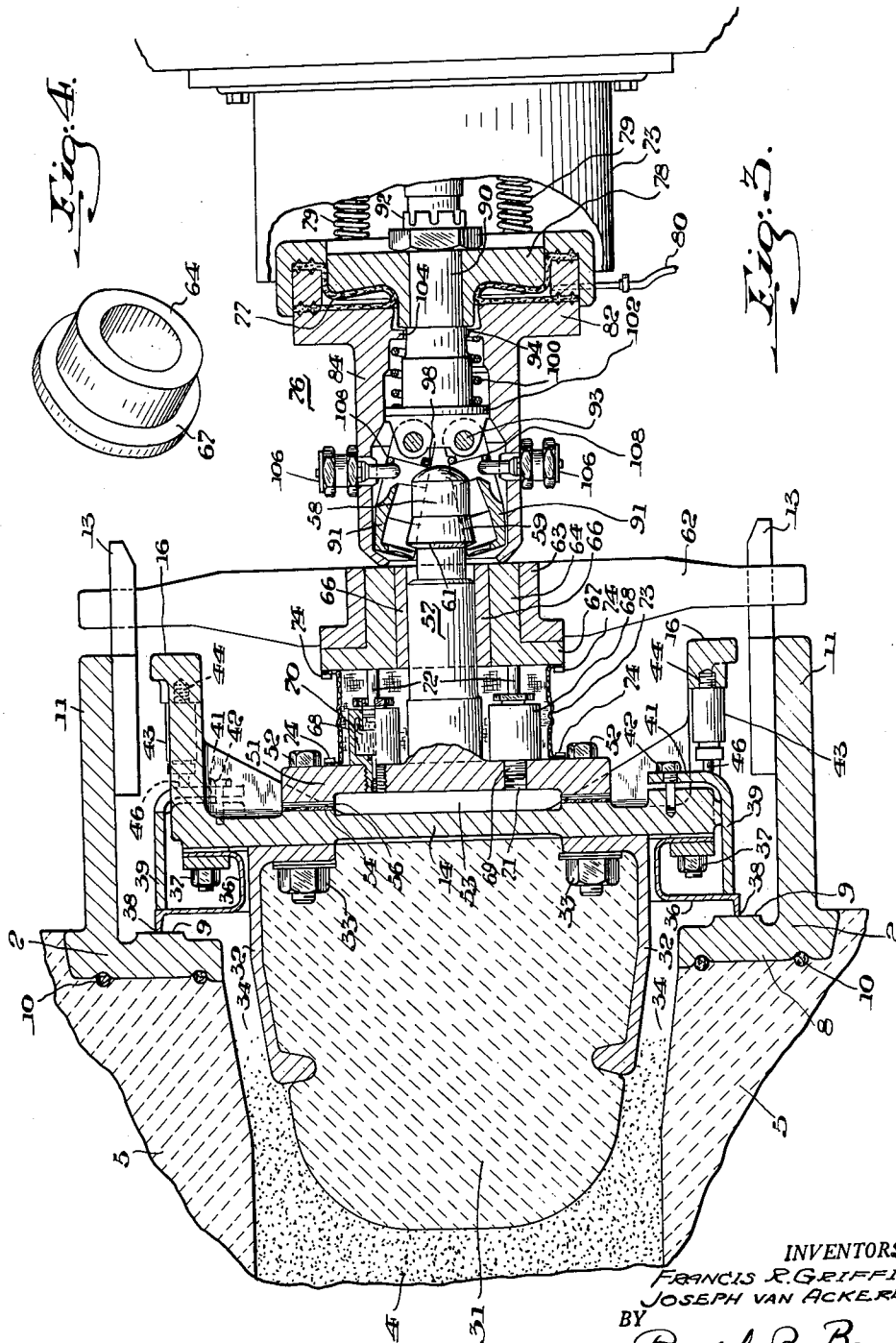
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3 Sheets-Sheet 2



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COKE OVEN DOORS

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3 Sheets-Sheet 3

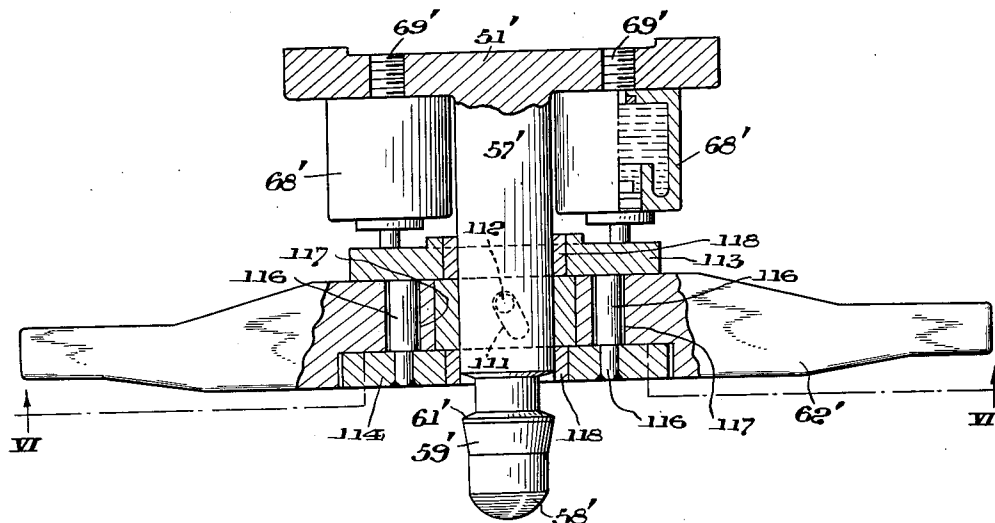


Fig. 5.

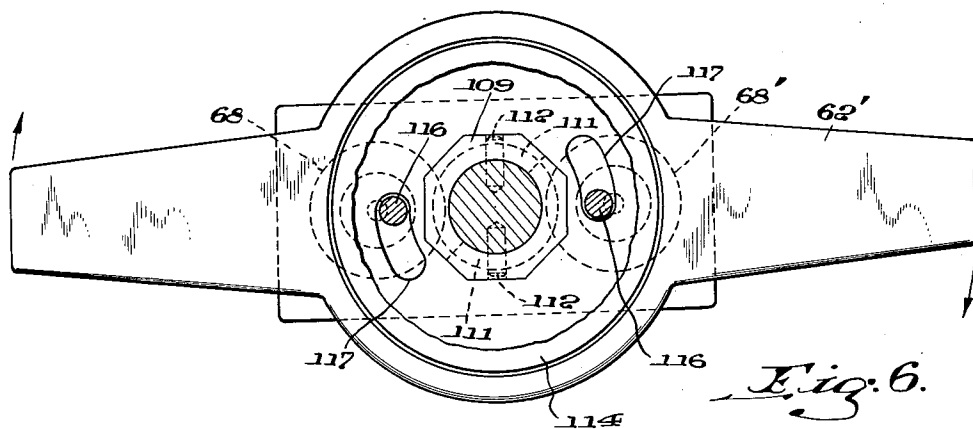


Fig. 6.

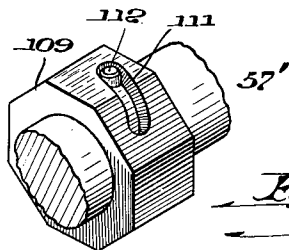


Fig. 7.

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3,032,483

COKE OVEN DOORS

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7 Claims. (Cl. 202-248)

This invention relates to coke oven doors and more particularly to improved coke oven doors of the self-sealing type for closing the ends of coking chambers of coking retort ovens.

As is conventional in the art, each of the coking chambers in a battery of coke ovens is surrounded at each end by a metallic door jamb frame, the jamb frame having an opening therethrough surrounded by a substantially flat sealing surface. A door is detachably secured to the jamb frame through door holding means attached thereto, the body of the door being provided with a flexible metallic sealing member having a narrow sealing edge which engages the sealing surface of the jamb frame throughout the circumference of the sealing surface. This sealing edge of the sealing member on the door body is enhanced in the sealing engagement with the sealing surface on the jamb frame by the inherent resiliency of the material of which the sealing member is constructed, the door being pressed through the door locking means with considerable force against the jamb frame to produce a reliable seal. To further insure effective sealing, spring pressed plungers are mounted on the door body, providing additional force to press the sealing edge of the sealing member against the sealing surface on the jamb frame.

In the past, pressure on the door locking means has been accomplished by conventional helical metallic springs mounted on the door body to generate a pressure between the body and locking means. Similar metallic springs, only of smaller size, have been used to exert pressure against slideable plungers mounted on the door body, the plungers, in turn, cooperating directly with the aforementioned sealing member.

These metallic springs which have been used to exert such pressure on the sealing member through the door locking means and on the sealing member directly have required frequent replacement, normal factors of wear coupled with the intense heats of the ovens effecting their spring life. Moreover, to obtain the desired sealing pressures, it has been necessary to use either a large number of such metallic springs in sizes so small at numerous short intervals around the door as to make construction and maintenance costs high, or to use only a few large metallic springs at widely spaced intervals in sizes so large as to obscure the vision of the oven operator, making it difficult for him to visually ascertain effective sealing.

More recently, structures have been designed to provide between the door body and locking means of the coke oven door a closed expansible chamber having incompressible inlet and outlet means for inflow to the expansible chamber for exerting the pressure formerly exerted in that area by metallic springs and outflow of the liquid from the chamber to release the door; however, these structures have proven to have a number of limitations also, the equipment required to maintain a liquid flowing under the intense heat of the coke oven being not only difficult to construct and operate but, in addition, being of questionable efficiency because of the constant possibilities of leakage and evaporation of the liquid supply during inflow and outflow.

The present invention solves the many aforementioned problems of the prior art by providing a structure which exerts the desired spring pressure on the sealing member of a coke oven door by means of a compressible liquid

2

or solid plastic material of limited compressibility in a direct, straightforward, economical manner, such structure being durable for the life of the door and being capable of withstanding the intense coke oven heats to which such door is subjected. In addition, the present invention provides a door structure which is so compact by reason of the use of a few small springs at widely spaced intervals as not to obscure the operator's vision, and which obtains the same uniform pressure throughout the entire sealing member as the few large springs or the numerous small springs. Further, the present invention provides a structure which permits effective and rapid fastening and unfastening of the coke oven door, eliminating much of the complex structure heretofore required to fasten and unfasten the latch bar means to effect proper door sealing, the present invention including means to automatically rotate the latch bar out of engagement with latch holding means on the door jamb when the latch bar is moved toward the door jamb.

More particularly, the present invention provides in a coke oven door having a door body with a sealing frame member mounted thereon cooperable with a sealing surface of a door jamb frame at the end of a coking retort oven, said jamb frame having door holding means attached thereto, an improved door arrangement comprising spring means of the preloadable type which utilizes a reciprocable piston cooperable with a compressible medium of the class of compressible liquid or solid plastic material of limited compressibility confined in and completely filling the space of an otherwise enclosed chamber to achieve resiliency, the compressible liquid or solid plastic spring means being arranged to cooperate with locking means of the door and with the sealing member itself to exert a resilient sealing force on the sealing member to place the sealing member into sealing engagement with the sealing surface on the door jamb frame when the door locking means engages the door holding means on the jamb frame. The above noted features of the present invention also provides an arrangement which lends itself to the use of a means which permits rapid fastening and unfastening of the locking means by providing automatic rotation through a pin and slot connection of such locking means into and out of engagement with the door holding means on axial movement of the locking means relative to the door.

Various other features of the present invention will become obvious upon reading the disclosure set forth herein.

It is to be understood that numerous changes can be made by one skilled in the art, in the arrangement, form, and construction of the apparatus disclosed without departing from the scope or spirit of the present invention.

Referring to the drawings:

FIGURE 1 is a front elevational view of an oven door showing one embodiment of the present invention;

FIGURE 2 is a vertical sectional view of the door of FIGURE 1 taken in a plane passing through line II—II of FIGURE 1;

FIGURE 3 is an enlarged horizontal sectional view of the door of FIGURES 1 and 2 taken in a plane passing through line III—III of FIGURE 1, and further including the power means used to fasten and unfasten the door locking means of the door;

FIGURE 4 is a perspective view of the thrust collar centrally disposed in the latch bar of FIGURE 3;

FIGURE 5 is a fragmentary horizontal view, a portion of which is in section, of a modified embodiment of the invention;

FIGURE 6 is a front elevational view of the structure of FIGURE 5 taken in a plane passing through the line VI—VI of FIGURE 5;

FIGURE 7 is a perspective view of the octagonal bushing appearing in FIGURES 5 and 6.

3

Referring to FIGURES 1-3 of the drawings, a door jamb frame designated broadly by the reference numeral 2 is shown at the end of coking retort oven 3, the chamber of which oven is shown in the drawings as containing a coal charge 4 (FIGURE 2). This chamber is formed by refractory sidewalls 5, roof 6 and bottom 7 of a battery of horizontal coking retort oven chambers, the roof, bottom, and sidewalls being recessed to receive the door jamb frame structure 2, and compressible packing material in the form of asbestos ropes 10 (FIGURE 3) being clamped between the jamb frame and the refractory oven.

The jamb frame 2 is comprised of a metal casting in the form of a hollow rectangle having a central opening of substantially the size of a horizontal end of the oven chamber and located substantially in alignment with such chamber. Referring to FIGURES 1-3 of the drawings, adjacent the inner margin of the jamb frame is a substantially flat portion 8, this flat portion having a flat sealing surface 9 extending completely around the opening through the jamb frame. As hereinafter explained, sealing surface 9 is engaged by knife edge 38 of flexible sealing frame member 36 carried by the door. Jamb frame 2 is in the form of a heavy steel casting and the sealing surface 9 is machined on this casting so that, at the time the jamb frame is constructed and installed, surface 9 is substantially flat and all portions of the surface throughout the circumference of the jamb frame are in the same plane. In this connection, it is to be noted that the jamb frame is a removable one, being held in place in a known manner by means of clamps cooperating with buckstays adjacent the jamb frame (not shown).

As can be seen in FIGURES 2 and 3, extending outwardly of flat portion 8 of the jamb frame is flange 11, the portions of this flange along the sides and top of the jamb frame structure extending substantially perpendicular to the flat portion 8 while the portion of the flange 11 across the bottom of the jamb frame extends at an angle in a known manner (not shown), so that the material pushed from the oven chamber will not remain on the jamb frame structure. At the upper end of the structure 2, a projection or ledge 12 is provided. This projection is disposed between the sealing surface 9 and the flange 11 of the jamb frame and is adapted to be engaged by a portion 18 of hook 17 on the upper end of a door to be described hereinafter in order to support such door during installation and removal.

Referring to FIGURE 3, the jamb frame has secured to each side thereof door holding means in the form of two latch or hook plates 13 which have hook recesses therein to receive the ends of latch bars carried on the outer face of the door to be described. Latch plates 13 are located on the inner face of the flange 11 and are secured to the flange by rivets or equivalent means.

The jamb frame heretofore described is of standard construction and the door provided by this invention is adapted to be employed with this jamb frame.

The door of the present invention is of such size as to fit within flange 11 on the jamb frame and to have a sealing member mounted on the door body as will be described hereinafter to cooperate with the sealing surface 9 of the jamb frame. The door body designated generally by the reference numeral 14 is substantially rectangular in shape and is of such size as to fit within the flange 11 and to overlie a portion of the sealing surface 9 on the door jamb frame when in operating position. The door body has a substantially flat central portion which is surrounded on its exposed or outward face by a flange 16 that projects from the flat central portion and is of such size and configuration as to be substantially in alignment with the sealing surface 9 on the door jamb frame structure 2 when the door is in closed position. The flange 16 is of substantial depth in order to make the door very rigid.

Referring to the upper portion of FIGURES 1 and 2

4

of the drawings, the door body 14 has formed integral therewith a hook 17 which includes a projecting portion 18 that is adapted to extend over and engage the ledge 12 on the door jamb frame to suspend the door from the door jamb frame before the latch bars 62 described hereinafter have been tightened and after they have been loosened. The projecting portion 18 is curved or convex so that when the door is supported from the ledge 12, the lower end of the door is free to swing, causing the door to assume a substantially vertical position. As can be seen in FIGURE 1 of the drawings, reinforcing ribs are provided in this area of the door jamb frame and door to accommodate the large weight which is concentrated there during placement and removal of the door.

The upper portion of the door body 14 has a rectangular opening 19 disposed therein to receive a leveller bar carried by a pusher machine (not shown). This opening is closed by a door 21 that is carried by a bracket 22 pivotally secured to the door body 14 in a known manner, the outer end of the door body having a latch member 24 thereon to engage the bracket 22 of the door 21 to hold the door in closed position. As is known in the art, a hand wheel 26 cooperates with the door 21 to press the door into engagement with the door body 14. The door 21 is curved in cross section (FIGURE 2) and has a relatively narrow sealing edge 27 which engages a flat sealing surface 28 on a guide member 29 positioned on the door body to tightly seal the leveller bar opening 19. Guide member 29 is made of relatively thick metal to serve as a guide for the leveller bar, the thick metal enabling it to withstand the forces exerted on it by the leveller bar.

Positioned below guide member 29 on the inner face of the door body are the refractory shapes or plugs 31 which comprise the liner of the door and which form the major portion of the inner face of the door. These plugs are held in place by liner retainers 32 (FIGURE 3), the retainers being bolted to the door body by means of the nut and bolt arrangements 33. The retainers and the plugs are of such width and depth as to project inwardly through the door opening and to extend between the sidewalls 5 of the coke oven chamber, but spaced from these walls a short distance so as not to engage them. As is known in the art, the coking chamber and the plugs are so arranged and proportioned that at each side of the door there is a long, relatively narrow space 34 between the door plug and the oven sidewall with the result that the granulated or finely ground coal charge 4 will not readily flow from the chamber through this space to the area adjacent the sealing surface 9 for the door body. This long narrow shape of the passage at each side of the door eliminates the flow of raw coal therethrough, reducing the amount of foreign material which will collect on the sealing surface 9 to interfere with the seating of the sealing edge on the door.

Secured to the inner surface of the door body 14 is a flexible sealing frame member designated generally by the reference numeral 36. This sealing frame member is rectangular in shape and is of such size as to surround but be spaced from the plugs 31 of the door and in the case of a pusher side door as is disclosed, to further surround the guide member 29 associated with the leveller bar opening. The sealing frame member 36 is formed of metal, preferably of an alloy steel which is resilient and corrosion resistant. The formation of this sealing frame member is well known in the art, the member being of substantially U-shaped cross section having one of the legs of such cross section attached to the door body 14 by spaced nut and bolt arrangements 37 and having its other leg provided with a narrow sealing knife edge 38, the face of which engages the sealing surface 9 on the door jamb frame.

In order to maintain the face of edge 38 of sealing frame member 36 in sealing engagement with the sealing surface 9 and to ensure that the pressure is uniform

throughout the sealing frame member, a bearing bar frame member 39 is provided to cooperate with one leg of the sealing frame member 36 and to exert a force in a substantially direct line therethrough to the face 9 of knife edge 38 by the sealing frame member 36. This bearing bar frame member 39 is of rectangular shape and is coextensive with the sealing frame member 36, being of sufficient depth to comprise a substantially rigid structure. Integral with member 39 along its inner side are a plurality of spaced apart ears 41, and threaded through each of these ears is a screw 42, the end of each of these screws being slideably disposed in one of a series of accommodating apertures in the door body 14. In this manner, the bearing bar frame 39 is floatingly mounted on the door body 14 with one of its edges bearing against the sealing frame member 36.

To exert the proper pressure on bearing bar 39, a plurality of spring members 43 are provided to act on the bearing bar at spaced intervals therealong. In accordance with the present invention, these spring members are of the type which utilizes a reciprocable piston cooperable with a compressible medium of the class of compressible liquid and solid plastic material of limited compressibility disposed in an otherwise enclosed chamber or zone to completely fill the space in said chamber to achieve resiliency, each spring member being mounted on the door body 14 in such a manner so as to effect pressure directly on the bearing bar. With such type compressible liquid and solid plastic spring members, it is possible to obtain great forces in a very small amount of space and, thus, only a few of such spring members are required at wide intervals as compared with small springs at short intervals as used in the past. Accordingly, the use of this type of spring members ensures that the operator's vision of the sealing member 38 is not obscured thus enabling the operator to ascertain readily the effectiveness of the seal that has been obtained when the door is latched into place. It is to be understood that any one of a number of compressible liquid and solid plastic variations of this type of spring members can be used which achieves resiliency by utilizing a reciprocable piston cooperable with a compressible medium of liquid or solid plastic of limited compressibility disposed in an otherwise enclosed chamber. For example, the spring members can be and are of the class of those disclosed in Patent No. 2,681,800, issued to P. H. Taylor on June 22, 1954, which makes use of the limited compressibility of solid plastic materials which completely fill the space in a piston chamber to achieve resiliency. And, in the advantageous embodiment of the invention disclosed, the spring members are also of the variety commercially known as "Wales Hydra Springs," each making use of a reciprocable piston 46 acting against a commercially known compressible fluid of limited compressibility disposed to completely fill the space in an otherwise enclosed piston chamber 50.

Referring to FIGURES 1-3, eight (8) such spring members 43 are disclosed, each having a threaded stud portion 44 integral therewith and screwed into the door body 14 along the door flange 16. The springs are spaced along the door body so as to have their pistons 46 cooperate with the bearing bar member 39 near each of the ears 41, there being a spring near each of the corners of the member 39 and two springs spaced apart and near the center portion of each of the sides of member 39. In one advantageous embodiment of the invention, each "Hydra Spring" is provided with a 2000 lbs./sq. in. preload force and with a maximum endload force of 4000 lbs./sq. in. It is to be understood that the preload force can be varied by means of a set screw torque adjuster which is incorporated in each of the "Hydra Springs," and, if so desired, other size "Hydra Springs" can be used.

As has been aforementioned, a difference of curvature arises during normal oven operations between the

sealing member 36 on the door body 14 and the sealing surface 9 on the jamb frame 2. More particularly, it is well known that most metals expand when heated, the amount of expansion being substantially in accordance with the increase in temperature. Therefore, since the inner face at 10 of the jamb frame 2 is heated much more than the outer face 9, the inner portion of the jamb 2 expands more than the outer portion with the result that the frame becomes curved with the concave side on the outer face of the jamb frame. Since the jamb frame is relatively narrow, the amount of curvature across the top and bottom of the frame is relatively small, but as the frame is quite long, the amount of curvature along the sides can be substantial. This outwardly concave curvature of the jamb frame, due to oven temperature increases, also occurs to the sealing frame member 36 mounted on the door body 14, only in the sealing frame member 36 of the door body the curvature is somewhat larger since buckstays (not shown) restrain the curvature on the jamb frame 2. Accordingly, the sealing frame member 36 on the edge 38 of door body engages the sealing surface 9 on the jamb frame at the center portions of the sides of the jamb frame on initial contact between the two members, there being a small clearance between the sealing member 36 and the sealing surface 9 at the top and bottom at the instant of such initial contacts. As can be seen in FIGURE 1 of the drawings, door body 14 is provided at each corner with threaded adjustable stop bolts 47 known in the art. These stop bolts are set back for a small distance from the face of the knife edge 38 of the sealing frame member 36, the face of which contacts the sealing surface 9 of the jamb frame structure. In operation, after the exertion of a selected force against the jamb frame, the stop bolts abut against the jamb frame preventing any further movement of the door body 14 towards the jamb frame and any overloading of the sealing frame member 36. Accordingly, the spring members exerting pressure near the corners of the bearing bar member 39 will be compressed only a limited distance as determined by the setting of stop bolts 47. On the other hand, to compensate for the above-described difference of curvature between the sealing frame member and the sealing surface of the jamb frame, and in order to effect a good seal therebetween, the spring members which exert pressure on the bearing bar member near the central portions of the sides of the bar member are compressed a substantially greater distance than those spring members near the corners. And, since it is desirable that the pressure load be uniform throughout the entire sealing frame member, the spring members near the corners and those near the central portions of the sides are preloaded in such a way that the corner spring members can be compressed the shorter limited distance to exert the same pressure at the point of effective sealing as the center spring members which are compressed a greater distance. Thus, it can be seen that with the use of spring members of the type wherein resiliency is achieved through a reciprocable piston cooperable with a compressible medium of the class of liquid and solid plastic material of limited compressibility disposed to completely fill the space in an otherwise enclosed chamber, it is possible to compensate for differences of spring travel and yet ultimately obtain uniform pressure throughout the sealing member. And, in the advantageous embodiment of the invention wherein "Hydra Springs" are used, these spring members are preloaded so as to exert uniform pressure when the pistons 46 of the center springs 43 are caused to travel $\frac{1}{4}$ of an inch and the pistons 46 of the corner springs 43 are caused to travel $\frac{1}{8}$ of an inch.

As is conventional in the art of horizontal coke oven doors, the door body 14 is provided on the outer side with an upper door lifting hook bracket 48 and a spaced lower door lifting hook bracket 49 secured to the door

body (FIGURES 1 and 2). These lifter hook brackets are adapted to receive lifting hooks on a door machine (not shown) to permit the door to be lifted and moved during its installation and removal from the ends of the coking chambers.

In order to fasten and unfasten the door into and out of engagement with the coke oven jamb frame structure, latch bar mechanisms are provided on the door to engage with the aforementioned door holding means or latch hooks 13. These latch bar mechanisms are mounted above the upper lifter hook bracket 43 and below the lower lifter hook bracket 49, respectively, so as to be in alignment with the latch hooks 13 for engagement therewith during coke oven door fastening operations. In accordance with one advantageous embodiment of the present invention and as shown in FIGURE 3, each of the latch bar mechanisms includes a casting 51 bolted to the door body 14 by means of the tap bolts 52. It will be noted that the door body and casting are matingly recessed to provide an air space 53 for ventilation therebetween with an insulation gasket 54 and adjusting shims 56 being interposed between the body and the casting. Integral with the casting is a spindle designated generally by the reference numeral 57, the spindle having a gripping knob 58 with a flared skirt portion 59 integral therewith to form a shoulder 61. As shown in the aforesaid patents and described hereinafter, shoulder 61 is engaged by the claw members 91 of a bellows motor 76 to unfasten a latch bar 62 which is rotatably and slideably mounted on the spindle 57.

The latch bar 62, which is generally of steel construction, has a centrally disposed brass collar bushing 63 press fitted therein, which in turn is rotatably mounted on a thrust collar 64 provided internally with a press fitted brass bushing 66 and slideably mounted on the spindle 57. Novelty interposed between shoulder 67 of thrust collar 64 and the outer face of casting 51 are the compressible liquid or solid plastic material spring members 68. These spring members 68 are, in accordance with the advantageous embodiment of this invention like the spring members 43 which are used to exert pressure directly along the sealing frame member 36, only they are larger, and so they also utilize a reciprocable piston cooperable with the compressible medium disposed in the otherwise enclosed chamber to achieve resiliency in sealing coke oven doorways. It is to be understood that any one of a number of variations of this type spring member also can be used and, in one advantageous embodiment of the invention disclosed, the springs are of the same variety as used with the sealing frame member, namely, "Wales Hydra Springs."

Referring to FIGURE 3, each of these springs 68 has a threaded stud portion 69 which seats in the tapped holes 71 located in the casting 51 on the door 14. In this connection, it will be noted that the springs are so located on either side of each spindle 57 that when the door is placed in fastening position at the end of a coking chamber, pistons 72 disposed in the otherwise enclosed chambers 70 of the springs abut the shoulder 67 of the thrust collar 64, in substantially the same horizontal plane as that in which the door holding means or latch hooks 13 lie. With the use of these springs 68 in place of the helical metallic springs heretofore known in the art, not only is a directly acting force on the latch bars obtained, as was heretofore obtainable, but, in addition, this force or thrust means is substantially larger for a substantially smaller area which was not heretofore attainable.

In one advantageous embodiment of the invention each of the springs can be adjusted to have a preload of 5500 lbs./sq. in. and an endload of 11,000 lbs./sq. in., it being noted that each of these liquid or solid plastic springs has a set screw for vernier adjustment of the preload, if so desired. Further, to protect the springs from the dust and intense heats of the coking retort oven chamber, an asbestos or canvas dust cover 73 is

interposed between the shoulder 67 of thrust collar 64 and the casting 51, this cover surrounding both the spindle 57 and the springs 68 and being held in place by the fastening screws 74.

As has been aforementioned, the thrust collar 64 for the latch bar 62 is slideable axially along spindle 57 into and out of position for fastening and unfastening of the latch bar 62 relative to the latch hooks 13 by means of a bellows motor 76. This motor is substantially like that disclosed in assignee's copending application Serial No. 346,480, now Patent No. 2,726,111, and is designated broadly by reference numeral 76 (FIGURE 3). Bellows motor 76 has a pneumatic or hydraulically operable expansible pressure chamber 77 to which is connected a fluid conduit 80 leading from a fluid supply and valve arrangement (not shown). A head member 78 forming one side of pressure chamber 77 is connected to the wall of a carrier means as disclosed in FIG. 3 in Cardan-joint fashion by springs 79. The other head 82 of the pressure chamber 77 has a forwardly projecting thrust cylinder 84 integral therewith, and in position to abut against the thrust collar 64 in latch bar 62 to urge the same inwardly to compress springs 68 when the pressure chamber 77 is expanded.

The head 78 of the pressure chamber 77 is fixed on a shaft 90 between a nut 92, screwed upon the shaft, and shoulder 94 integral with the shaft. One end of the shaft 90 passes through the wall of the carrier means in such a way, as described in FIGS. 4-6 of Patent 2,752,123, as not to interfere with the movement of the bellows motor 76, permitting claw members 91 disposed in cylinder 84 to pullingly engage with the gripping knob 58 of the spindle 57 on the door body 14 when the parts are not accurately centered. These claw members 91 are pivotally mounted to the other end of the shaft 90 by pins 93. The claw members are semi-circular in vertical cross section and are provided with hooked ends to grip the shoulder 61 formed by the flared skirt portion 59 of the gripping knob 58. The claw members are further provided in the vicinity of pins 93 with a sear type spring 98 which causes the claws to be spread open and clear gripping knob 58. When actuated, claws 91 embrace the shoulder of the gripping knob and are held thereon by the screw bolts 106, the screw bolts 106 being positioned in the walls of the thrust cylinder 84 and acting to ride upon the claws 91 when the shaft 90 is moved out away from the door jambs 2 for the door body and in opposite direction relative to simultaneous inward movement of the thrust cylinder 84. Such motion is produced by the expansion of the chamber 77, the pneumatic or hydraulic fluid in the chamber 77 pushing, on the one hand, the head 82 and thrust cylinder 84 integral therewith inwardly against the thrust collar 64 and, on the other hand, simultaneously pushing head 78 outwardly to move shaft 90 outwardly away from said door jamb 2. This opposite movement of shaft 90 outwardly with respect to the inward movement of the thrust cylinder 84 causes the screw bolts 106 to hold the hook ends of claws 91 in engagement with the shoulder of the gripping knob 58. The thus engaged claws pull the door body 14 away from engagement with the door jamb frame 2 and at the same time, the thrust cylinder 84 pushes the thrust collar 64 of the latch bar 62 inwardly to relieve the pressure exerted by the "Hydra Spring" members, through this thrust collar, on the latch bar 62. The latch bar 62 is then rotated out of engagement with the latch hooks 13 and the door can be removed by door carrier means (not shown). It will be noted that by use of the bellows motor, a power lock is created and no force is transmitted to the carrier means for the bellows motor. It will also be noted that the opposite directional movement of the claws 91 and the thrust cylinder 84 effect a compression of the Cardan springs 79 and of the spring 100, which spring 100 surrounds the shaft 90 and is positioned between collar 102 integral with the shaft 90 and the corre-

9

sponding collar 104 integral with the head 82. When the chamber 77 is allowed to contract, such as will occur when fastening a properly aligned latch bar 62, the springs 79 and 100 expand. The thrust cylinder 84 then moves away from the thrust collar 64 causing the screws 106 to come into engagement with the projections 108 that are positioned on the claw members 91 to pivot the claw members apart. Thus, the claw members are pivoted out of engagement with the gripping knob 58 and the bellows motor is disengaged from the spindle, springs 68 then acting through thrust collar 67 to force latch bar 62 into engagement with the latch hooks 13.

Referring to FIGURES 5-7 of the invention, there is shown a further modification of the successively developed door mechanism wherein means is provided to cause the latch bar 62' to rotate automatically relative to the latch bar support member or spindle 57' when the latch bar is caused to slide relative to the spindle toward the door jamb frame 2. More particularly, this means comprises an octagonally shaped bushing 109 centrally disposed within the latch bar 62', the latch bar 62' thus being caused to rotate with the bushing 109 when the bushing is caused to rotate as will be seen hereinafter. The bushing 109 which is slideably mounted on the spindle 57' has a pair of cam tracks 111 disposed therein on its opposite sides. Engaged in these cam tracks 111 are cam follower posts 112 fixed to opposite sides of spindle 57'. Positioned on either side of the latch bar 62' and slideably mounted on spindle 57' are the thrust followers 113 and 114, a recess being provided on the outward face of the latch bar 62' to receive the thrust follower 114. These thrust followers are separated and spaced from each other by spaced apart spacer pins 116 which are fixed to the thrust follower 114 so as to abut against the side of the follower 113. In this connection, it will be noted that pins 116 are spaced so as to be positioned on either side of the spindle 57', these pins projecting through arcuate slots 117 provided in the latch bar. It will be noted slots 117 have their center of curvature on the axis of spindle 57'. It also will be noted that sufficient clearance is provided by means of pins 116 between the latch bar 62' and the spaced apart thrust followers 113 and 114 to permit the latch bar 62' and the bushing 109, which is of the same thickness as the latch bar, to rotate between the spaced apart followers, the arcuate slots 117 in the latch bar further permitting such rotation of the latch bar about the spacer pins 116. In order to permit the followers 113 and 114 to slide along the spindle 57' these followers are provided with centrally disposed brass bushings 118 which are press fitted with the followers to slide on spindle 57'.

In unfastening operations of a coke oven door which includes the above cam means, when an unlatching force is exerted inwardly on the thrust follower 114, the latch bar 62' interposed between spaced apart followers 113 and 114 is caused to slide inwardly on spindle 57' along with the followers, follower 113 acting against the pressure of the "Hydra Springs" 68' to compress the same and remove the latch bar 62' from engagement with the latch hooks 13 on the coke oven door jamb frame 2. In this connection, when latch bar 62' slides along spindle 57' the aforescribed octagonal bushing 109 which is centrally disposed in the latch bar, also slides along the spindle 57' and, because of the cam tracks disposed in bushing 109 and engaged by the cam follower posts 112 mounted on the spindle 57', the bushing 109 is caused to rotate. This, in turn, causes the latch bar 62' surrounding such bushing to rotate. Thus, in this manner, the latch bar is rotated out of engagement with the latch hooks automatically by the same movement which compresses the springs 68 to allow the latch bar to slide inwardly to an unfastened position relative to the door latch hooks 13.

What is claimed is:

1. An improved coke oven door arrangement, compris-

ing: a coke oven door having a door body with a peripheral sealing frame member mounted thereon cooperable with a peripheral sealing surface on a door jamb frame disposed at the end of a coking retort oven, and having door latch bar retainer means attached thereto; a latch bar mounted on said door body for movement toward and away from said latch bar retainer means; first spring means of the preloadable type comprising a reciprocable piston cooperable with a compressible material of limited compressibility disposed to completely fill the space in an otherwise enclosed piston cylinder chamber to achieve resiliency, said first spring means being interposed between said door body and said latch bar to constitute the total door locking force between said door and latch bar which maintains said latch bar in releasable engagement with said latch bar retainer means on said jamb frame; a peripheral series of second spring means of the same preloadable type comprising a reciprocable piston cooperable with a compressible material of limited compressibility disposed to completely fill the space in an otherwise enclosed piston cylinder chamber to achieve resiliency, said second spring means cooperating with said peripheral sealing frame member on said door body to create a resilient sealing force on said peripheral sealing frame member when in sealing engagement with said peripheral sealing surface on said door jamb frame when said latch bar engages said latch bar retainer means under the spring force of said first spring means; and a pin and cam slot connection between the door and the latch bar for rotation of the latch bar into and out of engagement with the latch bar retainer means on movement of the latch bar toward and away from said latch bar retainer means.

2. Apparatus as claimed in claim 1, and which includes power means including a fluid pressure actuated motor with means to grip a part on said door and means to abut said spring means in a straight line motion, when said motor is actuated to pull on said door body in a direction away from said door jamb frame and to simultaneously push said spring means toward said jamb frame, thereby compressing said spring means to release said latch bar from engagement with said latch retainer means on said jamb frame.

3. An improved coke oven door arrangement, comprising: a coke oven door having a door body with a peripheral sealing frame member mounted thereon and cooperable with a peripheral sealing surface of a door jamb frame disposed at the end of a horizontal coking retort oven and having latch bar retainer means attached thereto; a latch bar spindle fixed to said door body; a latch bar rotatable around and axially slideable along said spindle; spring means interposed between said latch bar and said door body to create a door locking force against said latch bar retainer means on said jamb frame; and pin and cam slot connection between said spindle and said latch bar to rotate said latch bar into and out of engagement with said latch bar retainer means when said latch bar is caused to slide along said spindle.

4. Apparatus as claimed in claim 3, and which includes power means including a fluid pressure actuated motor with means to grip a part on said door and means to abut said spring means in a straight line motion, when said motor is actuated to pull on said door body in a direction away from said door jamb frame, and to simultaneously push said spring means toward said jamb frame, thereby compressing said spring means to release said latch bar from engagement with said latch retainer means on said jamb frame.

5. Apparatus as claimed in claim 3, and in which the pin and cam slot connection comprises a bushing centrally disposed in said latch bar to rotate and slide therewith relative said spindle, said bushing having a cam track disposed therein, and a pin cam follower fixed to said spindle and in engagement with said cam track to cause said bushing and latch bar associated therewith to

11

rotate relative said spindle into engagement with the latch bar retainer means when said latch bar is caused to slide relative said spindle toward the latch retainer means on said door jamb frame.

6. An improved coke oven door arrangement, comprising: a coke oven door having a door body with a peripheral sealing frame member mounted thereon co-operable with a peripheral sealing surface of a door jamb frame disposed at the end of a horizontal coking retort oven and having latch retainer means attached thereto; a latch bar support member fixed to said door body; a latch bar rotatable and axially slideable relative said support member; spring means of the preloadable type comprising a reciprocable piston cooperable with a compressible material of limited compressibility disposed to completely fill the space in an otherwise enclosed piston cylinder chamber to achieve resiliency, said spring means being interposed between said latch bar and said door body and constituting the total door locking force between said latch bar and door which maintains said latch bar in releasable engagement with said latch retainer means on said jamb frame for effecting the sealing engagement of the peripheral sealing frame member on the door with the peripheral sealing surface on said door jamb frame, and cam means cooperable between said latch bar support member and said latch bar to cause

12

said latch bar to rotate into and out of latching relation with the latch retainer means when said latch bar is caused to slide relative thereto.

7. Apparatus as claimed in claim 6 and which includes power means including a fluid pressure actuated motor with means to grip a part on said door and meant to abut said spring means in a straight line motion, when said motor is actuated to pull on said door body in a direction away from said door jamb frame, and to simultaneously push said spring means toward said jamb frame, thereby compressing said spring means to release said latch bar from engagement with said latch retainer means on said jamb frame.

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