

July 23, 1957

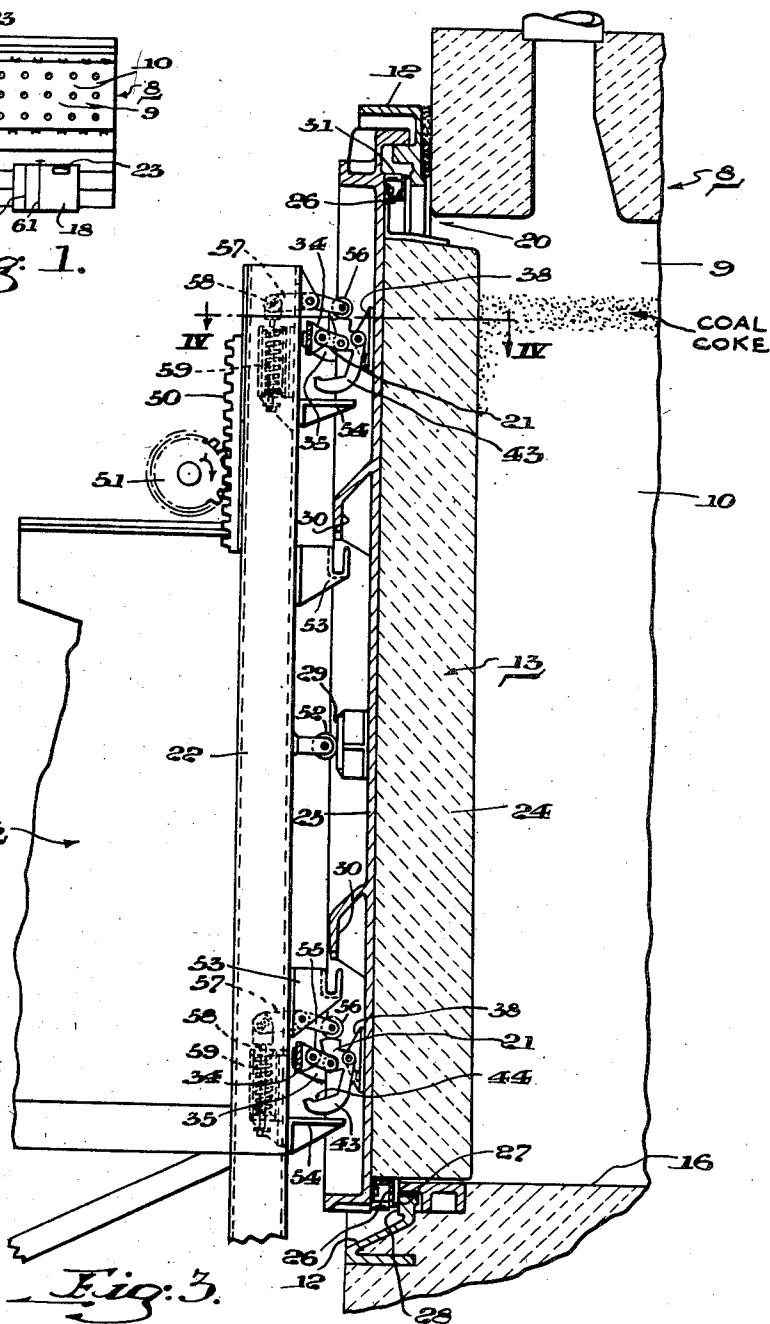
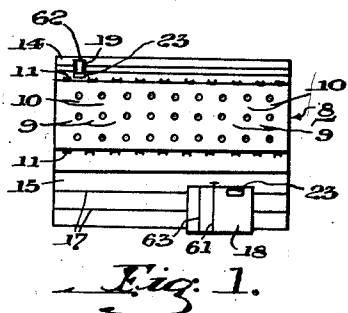
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2,800,435

COKE OVEN DOOR CLOSURE APPARATUS

Filed July 6, 1956

6 Sheets-Sheet 1



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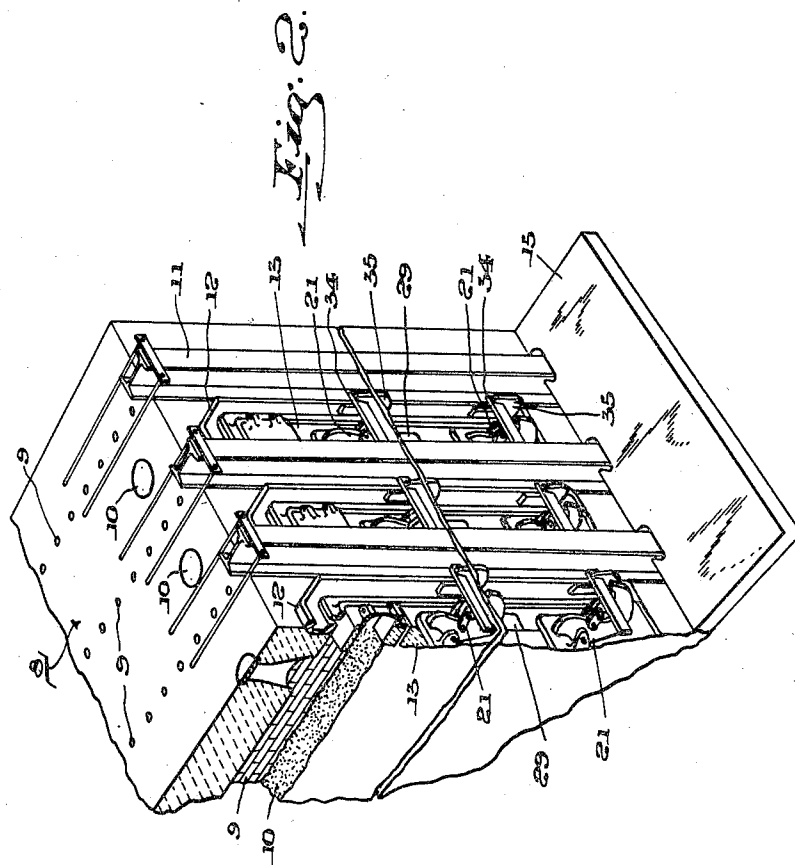
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COKE OVEN DOOR CLOSURE APPARATUS

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6 Sheets-Sheet 2



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COKE OVEN DOOR CLOSURE APPARATUS

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6 Sheets-Sheet 3

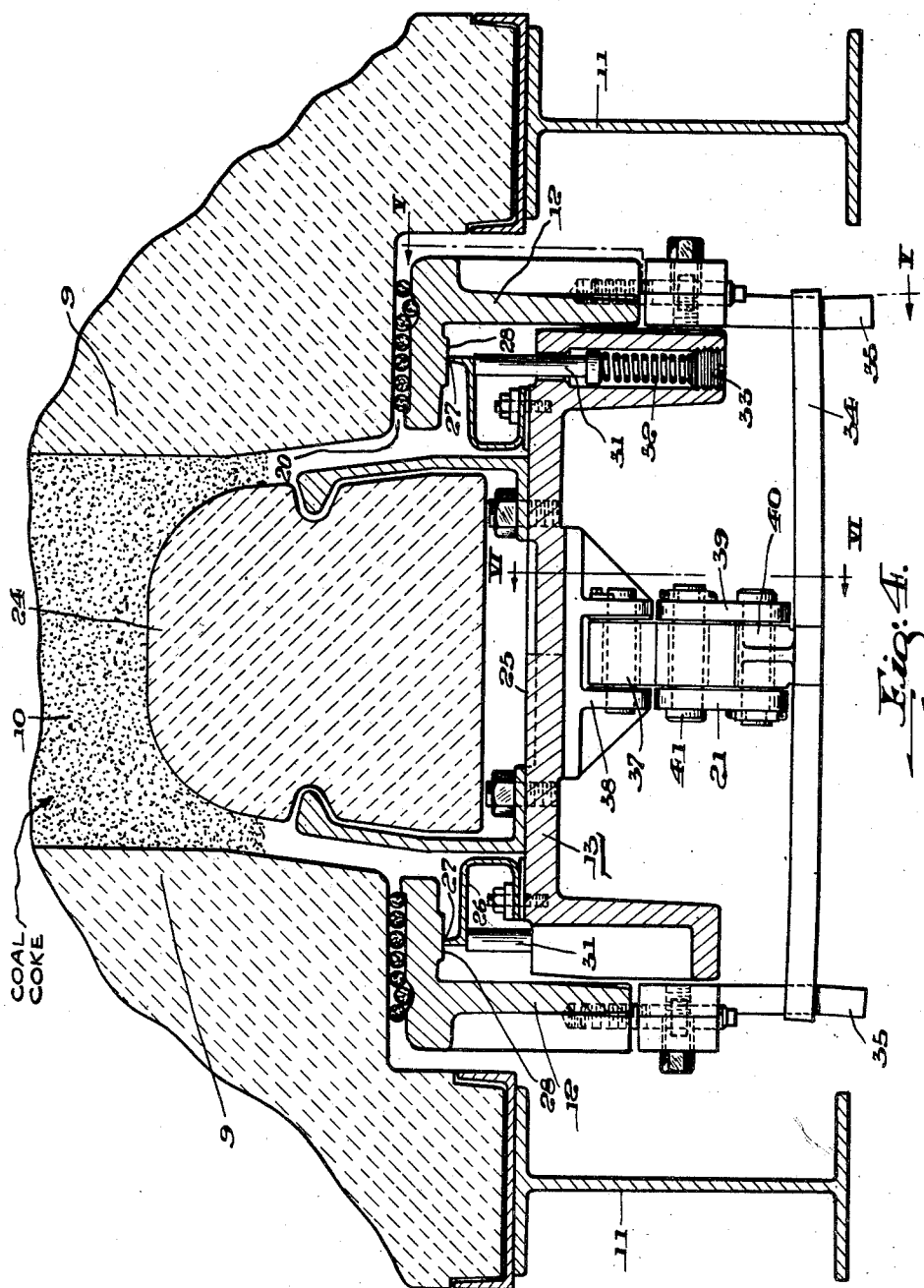


Fig. 4.

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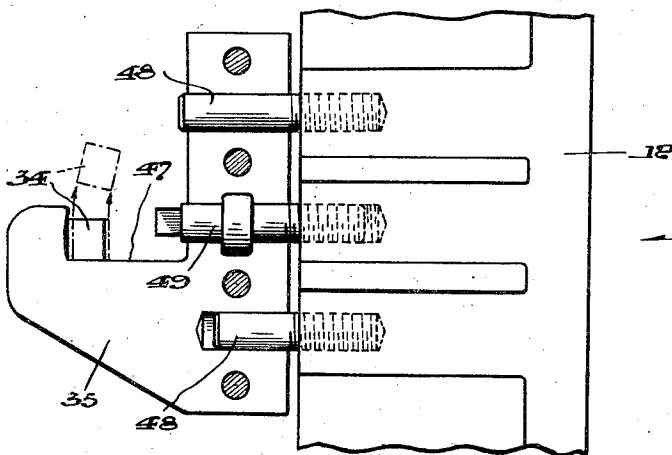
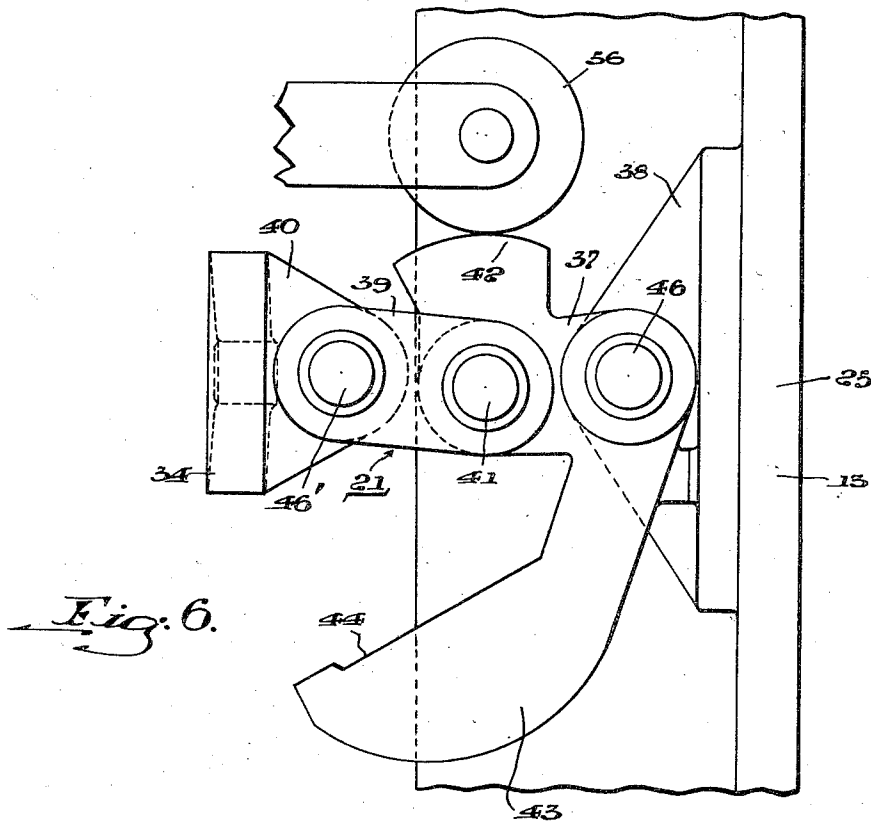
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COKE OVEN DOOR CLOSURE APPARATUS

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6 Sheets-Sheet 4



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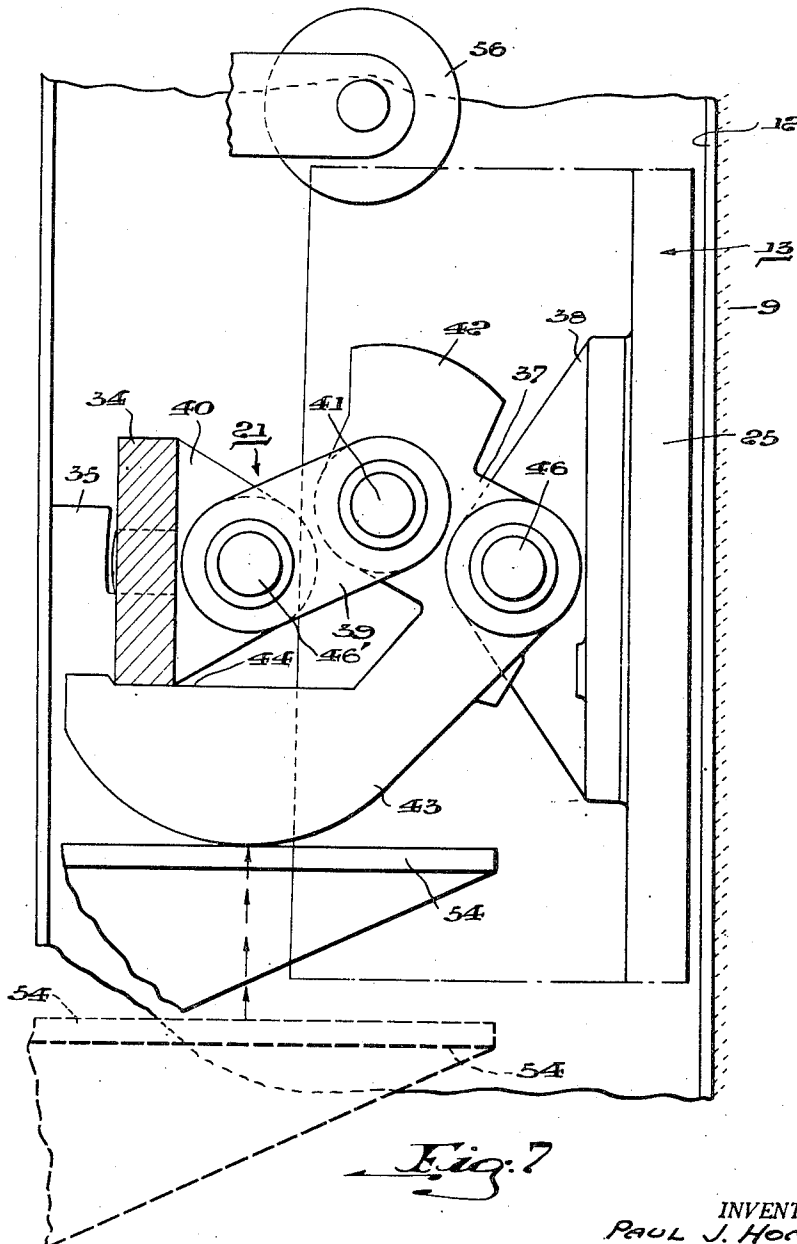
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COKE OVEN DOOR CLOSURE APPARATUS

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6 Sheets-Sheet 5



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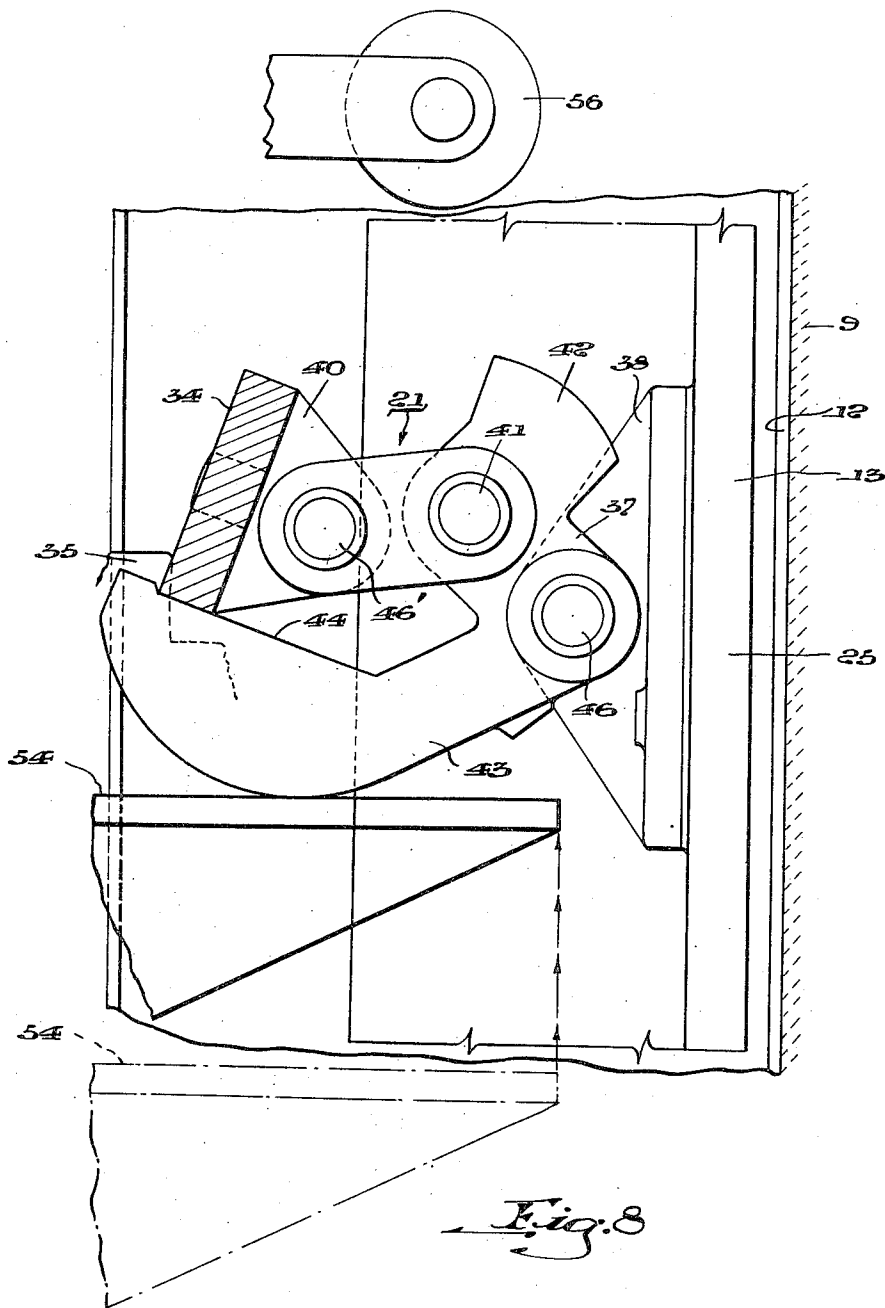
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COKE OVEN DOOR CLOSURE APPARATUS

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6 Sheets-Sheet 6



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COKE OVEN DOOR CLOSURE APPARATUS

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Application July 6, 1956; Serial No. 596,317

12 Claims. (Cl. 202—248)

The present invention relates primarily to improvements in the general operation of horizontal coking retort ovens and more particularly to a distinct arrangement of different parts for opening and closing the doorways at the horizontal ends of said chambers for discharge of coke from a battery of said ovens whereby to eliminate the leakage that obtains after some years of use with cam latched doors.

The invention is primarily designed and adapted for operation with self-sealing doors as commonly employed in this art, but is not limited in all its aspects to self-sealing doors, since the novel features of the invention are of utility and equal application to other types of such coke oven doors, such as luted doors.

A primary object of the invention is to provide an arrangement for cam or wedge latching of the doors in closing the oven chamber doorways, between the intervals of pushing coke from such batteries of oven chambers, which arrangement retains all the advantages of simplicity in construction and operation, and more economical and facile operation, of this part of the sequential operation of horizontal coke oven batteries for the production of metallurgical coke, as is afforded by cam or wedge latching of said doors, while eliminating the disadvantages of such cam latched operation as a result of the exigencies of operation of such doorways over a period of years.

Such cam or wedge latching of these doors has the advantage of being capable of operation by means of a simple mechanism with a simple to and fro movement. In addition the door and its sealing surfaces and the door frames are free of the external pressure exerted by the latch of operating means in locking and releasing the latch. The door and its sealing surfaces are sealed always with the same degree of pressure, since the cams or wedges established substantially the same pressure between the sealing surfaces or edges on the door and the sealing surfaces on the door frame whenever an oven door is returned to closed and sealed position for recharging the oven chamber after removal of the door from the oven chamber doorway for a previous pushing operation to remove finished coke from the oven.

However, such cam or wedge latched coke oven doors have not been readily and widely adopted in commercial practice, since after several years of service the cams or wedge surfaces, which govern the degree of sealing pressure, soon become worn, with the result that in the sequential operation of the doors, as a part of a battery of ovens, the different sealing edges around the margins of the different doors fail to seat gas tight, so that gas from the oven chambers burn around the margins of the doors at their sealing surfaces.

As a consequence, it is often necessary for the supervisory personnel to constantly inspect the doors after each reclosure of the oven doorways, and to manually reset the pressure screws on the margins of the doors to stop the gas leaks at the sealing margins. This has deterred the wide spread adoption of such otherwise simple

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form of coke oven door closure operation, with a loss of its aforesaid advantages in the general operation of coke oven batteries, since such constant surveillance or policing, interferes with the timed sequential operation of these doors and of other appurtenances incident to the general object of producing coke from such ovens.

For instance with self-sealing doors as now common in the art, it is essential that the sealing surface on the door frame be ground to a degree of smoothness in a single plane so that all around the door, such surfaces show no variation in depth greater than .006 of an inch within each foot of the door frame, to provide a continuous rectangle ground flat to a true plane. With continued use, there often is distortion under heat, and due to expansion of the brickwork of the portion of the battery around the doorway, variations occur in the level of the sealing surfaces.

This variation is compensated during the several years of service in the early part of the expected longer life of these doors by adjustment of the sealing edge or surface on the door to the altered surface in the door frame. But the normal wear of the cam or wedge surfaces that eventually takes place with constant use, results in a different imperfection in seating of the door seal on each successive reclosure of these doors after each successive pushing operation and recharging of the separate ovens with its next batch of coal. The exigencies of operation in sequential manipulation of the various parts of this portion of a coke oven battery is such that it is impractical to correct the alteration of the cam or wedge surfaces for the latches for the doors for each oven every time they are removed and replaced. Usually the ovens are pushed and recharged on a schedule calling for the emptying and refilling a different oven every ten to fifteen minutes, and for removing and replacing a door within about three minutes.

As a substitute for such cam latch operation, reliance has been on the use of springs for exerting such sealing forces on these doors, in lieu of cams and wedges. This necessitates higher maintenance and more complicated and costly devices.

Accordingly the present invention provides the doors with such wedge or cam action by means of a toggle lock, preferably of the double arm center lock type. In this manner all of the advantages heretofore attainable with cams or wedges in latching and unlatching coke oven doors is attained, without the disadvantages that heretofore existed with their cam operation do to wear of the cam or wedge surfaces. While these cam or wedge surfaces still wear off with years of constant use, the disadvantages of creeping and loosening up of the doors seals that heretofore took place throughout the coking period, as a result of variations in pressure, temperature, expansion and contraction, by reason of the cam wear, is eliminated. While the pivots show wear, the effect of the wear is not felt at the seals due to the toggle being still past its dead center in locking position. Once past dead center, the force of the toggle in its closed position is still felt on the latch and door frame regardless of the wear on the cam or wedge surfaces provided at the pivots of the toggle. Relaxing of the wedge or cam force of the toggle is felt at the door seating surface only when the toggle moves past dead center to its unlocked position. There can be no shortening of the widest wedge distance of the locked toggle until the toggle moves past the axis of its center to unlocked position.

In accordance with the invention a double arm center lock toggle is preferred for this specific purpose because it permits of considerable movement, in a direction where space is available in coke oven doors, to produce a very small movement and consequently a powerful pressure or

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thrust in the closing direction of the door relative to the door frame, where the available space is limited.

In addition to the general objects recited above, the invention has for further objects such other improvements and advantages as may be found to obtain in the novel arrangement of these different parts as hereinafter set forth and claimed.

Figure 1 is a schematic plan view of a horizontal coke oven battery equipped with the present invention.

Figure 2 is a perspective view of a portion of the door parts of the battery.

Figure 3 is a vertical sectional view taken through one of the doors and part of a coking chamber, illustrating the toggle arrangement and operating means in final closed position.

Figure 4 is a horizontal cross-sectional view taken on the line IV—IV of Figure 3.

Figure 5 is a side elevational view, part being in section, taken on the line V—V of Fig. 4.

Figure 6 is a similar view taken on the line VI—VI of Figure 4, showing the closed position of the toggle.

Figure 7 is a view similar to Figure 6 showing the opening position of the toggle.

Figure 8 is a view similar to Figure 7 showing the lifting position of the latch bar and toggle.

Referring to the drawings there is shown a coke oven battery 8 which includes a series of alternate heating walls 9 and coking chambers 10 cross braced by buckstays 11 at opposite ends of the heating walls. Each oven chamber is surrounded at its two opposite horizontal ends by a removable door frame 12 that is closed by a removable door 13.

As conventional the battery 8 is provided with a coke side bench 14 and a pusher side bench 15 at or below the level of the soles 16 of the oven chambers 10, and a pusher machine trackway 17 on which travels the usual pusher machine 18 for pushing the finished coke cakes out of the many ovens in a predetermined timed sequence. The cakes of coke when pushed pass out over a coke guide 19 on the coke side bench 14 to a car, wharf, or other means.

In the general operation of these batteries, due to the many different sequence steps to be performed on opposite sides of the battery, all mechanisms must be capable of successful operation from the coke guide machine 19 or the pusher machine 18 to avoid interference or interruptions to overlapping operations at different regions along the battery 8.

In accordance with the present invention the ends 20 of the coking chambers 10 are closed by removable doors 13 of the conventional self sealing plug type with the difference that all their parts are actuated to sealing position by a toggle lock 21 on the doors, with the toggle of the different doors operated by a simple toggle operating means by a to and fro movement of a single device 22 on the coke guide 19 or pusher machine 18 that moves alongside the coke oven battery from one to the other of the different doors 13 in conformity with the time sequence of the pushing and charging schedule of the battery.

The toggle operating means is mounted on a door head carrier 23, which is mounted as conventional, one on the pusher machine and one on the coke guide machine, for movement toward and from the several oven chambers in unseating and reseating the doors in the door frames 12 around the doorways 20.

The door as shown and preferred is of the type of Joseph van Ackeren British Patent 681,073 of November 25, 1951.

Advantageously such door comprises an inner plug section 24, an outer rigid metallic supporting section 25 and a surrounding marginal flexible metal sealing section 26 terminating in an inwardly extending sealing knife edge 27 for metal to metal sealing contact with a continuous marginal flat plane sealing surface 28 on the exterior of the door frame 12. The door 8 is also provided

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as conventional with a centering bearing 29 and lifting lugs 30 whereby the door may be lifted in removing it from, and replacing it in, the door frame 12 by the operation of the door carrier 23.

In addition the door is also constituted of a marginal series of spring pressed pressure plungers 31 the springs 32 of which are adjustable by a screw 33 for conforming the sealing edge 27 to irregularities in the sealing surface 28 on the door frame 12.

For latching the door as a whole gas tight in the doorway 20, a pair of upper and lower latch bars 34 are provided for removable insertion in door retainer means in the form of door hooks 35 arranged on opposite sides of the door at the exterior of the same. These door hooks

are anchored to the battery 8, as by attachment to the buckstays 11 or to the door frame 12. Preferably they are attached to the outwardly extending web 36 of the door frame 12 which is held in place, as conventional, by brackets (not shown) fastened to the buckstays 11.

In accordance with the present invention the latch bars 34 are moved toward and away from the latch hooks 35 and the outer supporting section 25 of the door, in latching and unlatching the same in gas tight sealing relation with the sealing surface 28 of the door frame 12 by means of the toggles 21.

The toggles are of the double arm center lock type each of which has one arm 37 pivoted at 46 to a bracket 38 secured to the door back 25 and the other arm 39 pivoted at 46' to a bearing 40 attached to the longitudinal center of the latch bar 34, with both arms pivoted to each other centrally of the toggle as at 41.

One arm, preferably the arm 37, is provided above the toggle with a striker head 42 and below the toggle with a lifting hook 43 for locking and unlocking the toggle 21. The lifting hook 43 terminates in a latch lifting part 44 in position relative to the pivot 46 between the arm 37 and the door bracket 38, to engage and lift the latch bar 34 out of the pockets 47 for the bar in the hooks 35 so as to clear the door hooks 35 in releasing the door 8.

The latch hooks 35 are of the adjustable type comprising guide screw bolts 48 and a setting screw bolt 49 for adjusting the distance between the hooks 35 and the sealing surface 28 on the door frame 12.

For locking and unlocking the door, the single operating means 22 comprises simply a vertically reciprocable rack 50 operable by a pinion 51. This pinion is manipulable by both hand or power operated means from the pusher machine 18 and the coke guide machine 19.

The rack 50 is provided with a roller 52 for centering the same to the door by rolling contact with the bearing 29, and with a pair of lifting hooks 53 for lifting engagement with the door lifting lugs 30. In addition two pairs of strikers are mounted on the rack 50 for striking engagement of each pair with the striker heads of the pair of toggles on any one of the doors of the battery in latching and unlatching the door sequentially for pushing and recharging the ovens with coal to be coked. One striker of each pair comprises a lower member fixed to the rack 50 in the form of a rigid bracket 54 which is positioned on the rack 50 to lift the lower striker hook 43 as the rack is raised in unlatching the door. The other striker of each pair on the rack is positioned thereon to depress the upper striker head of its toggle as the rack is lowered by the pinion. The upper strikers are in the form of a pivoted double arm lever 55 having a roller 56 at the end of one arm to strike the upper head 42 and having its other arm 57 provided with a reciprocable tension rod 58 under tension of a spring 59 urging the striker 55 in the direction of the striker head 42 thus providing a cushioning action during the locking of the toggles, and a yielding action on withdrawal.

The lifting hooks 53 are positioned on the rack 50 to first encompass the lugs 30 as the rack begins to rise in unlatching the door, before the fixed striker brackets 54 strike the lower striker hooks 43 to break the toggle

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from the closed position shown in Fig. 6 to the open position shown in Fig. 7. When the rack 50 reaches the position shown in Fig. 7, further vertical movement of the rack results in the door hooks 53 exerting a lifting force on the door lugs 30 as the fixed strikers 54 elevate the latch bars 34 from the position shown in Fig. 7 to the position shown in Fig. 8, wherein the latch bars are clear of the latch hooks 35.

The upper strikers 56 are positioned on the rack 56 so that as the rack descends in reseating the door the toggles are locked before the lifting hooks 53 drop out of the lifting lugs 30, and further downward movement of the rack to release the lifting lugs 30, with the door in seated position, results in lifting of the striker rolls 56 against the tension of springs 59. Thereupon, the door carrier 23 can be retracted leaving the door 8 in fully seated, latch sealed, relation on the sealing surface 28 of the door frame 12.

In operation the pusher machine 18 and coke guide machine 19 are automatically propelled to the different oven chambers in accordance with the conventional timed sequence and spotted to center the roll 52 in alignment with the bearing 29 on the doors at opposite ends of the oven to be pushed. Thereafter, the door carriers 23 are advanced across the benches 14, 15 to abut the bearings 29 on the door between the buckstays 11 on opposite sides of the door. On operation of pinion 51, rack 50 rises, first bringing the door hooks into grasping relation with the upper and lower lugs 30, and on further use of the rack 50 the lower striker brackets 54 strikes the striker hooks 43 rotating arm 37 about pivot 46. This moves the center pivot 41 upwardly past dead center unlocking the toggle from the position shown in Fig. 6 to the position shown in Fig. 7, thus releasing the latch bar 34 and door 8 from its cammed or wedged relation with its door frame 12. In the final elevated position of the rack 50, the striker brackets 43 engage the latch bars 34 as shown in Fig. 8 carrying the latch bar clear of the door hooks 35 as the door lifting hooks 53 lift the lugs 30 in unseating the door 8 from the door frame 12. Thereafter the door carriers 23 are retracted to withdraw the door plug 24 from within the doorway 20 until the plug section is withdrawn from between the buckstays 11 to clear the outer portions of the same, and the carriers moved aside, as by turning them on the pusher and coke guide machines or by shifting the latter machines along the battery to bring the pusher ram 61 and coke guide 62 into alignment for pushing the coke cake out of the chamber. After this operation the carriers are respothed before the doorways and advanced to re-insert the door plugs 24 into the doorways 20, and the pinion 51 rotated in the opposite direction to lower the door lifting hooks 53. During this operation the upper strikers 56, strike the striker heads 42 forcing the pivots 41 down past dead center. As this step of the operation takes place, the hooks 43 rotate counterclockwise allowing the latch bar to re-engage in the pockets 47 and the downward movement of the pivot 41 elongates the double arms forcing the door back 25 towards the doorway 20 and the latch bars towards the door hooks 35, thus camming or wedging the sealing edge 27 against the sealing surface 28. On further downward movement of the rack 51, the hooks 53 move out of the path of lugs 30 and in so doing the striker roller 56 is raised about its pivot depressing arm 57 against the tension of spring 59. The carriers 23 are then retracted leaving the door 8 in sealed relation with the door frame 12 for recharging the oven with coal which is levelled by reciprocation of the leveler bar 63 on the pusher machine. Any wear of the cam or wedge surfaces, as at the pivots 41, 46, 46', does not result in leakage at the door seals 27, 28, since they are still held tight by the toggle arms remaining past dead center as shown in Figures 3 and 6. The latch bar 34, and door 8, and marginal sealing ring

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26 providing resiliency to continue such gas tightness at the sealing surfaces 27, 28.

The invention as hereinabove set forth is embodied in a particular form of construction but may be variously embodied within the scope of the following claims.

I claim:

1. Coke oven door closure apparatus for a horizontal coke oven chamber with a doorway at one end of the chamber and a sealing surface around the margin of the doorway, comprising a door with a marginal sealing member extending around the margin of the door for sealing engagement with the sealing surface around the margin of the doorway; oppositely disposed door retainer means mounted exteriorly of the door on opposite sides of the same; a latch bar spanning the door between the same and said oppositely disposed door retainer means for securing in, and releasing the door from, gastight relation between its marginal sealing member and the marginal sealing surface around the doorway; a toggle lock between said door and said latch bar, said toggle lock having an arm thereof pivoted to said door and another arm pivoted to said latch bar with a pivotal connection between the arms for effecting pressure movement of the door and latch from each other to secure them in place by the retainer means.

2. Apparatus as claimed in claim 1, and in which the toggle lock comprises a double arm center lock toggle.

3. Coke oven door closure apparatus for a horizontal coke oven chamber with a doorway at one end of the chamber and a sealing surface around the margin of the doorway, comprising: a door with a marginal sealing member extending around the margin of the door for sealing engagement with the sealing surface around the margin of the doorway; oppositely disposed door retainer means mounted exteriorly of the door on opposite sides of the same; a latch bar spanning the door between the same and said oppositely disposed door retainer means for securing in, and releasing the door from, gastight relation between its marginal sealing member and the marginal sealing surface around the doorway; a toggle lock between said door and said latch bar, said toggle lock having an arm thereof pivoted to said door and another arm pivoted to said latch bar with a pivotal connection between the arms for effecting pressure movement of the door and latch from each other to secure them in place by the retainer means, a door lifting lug on the door, a carriage movable alongside the oven chamber into and out of position for lifting and reseating the door relative to said chamber doorway, operating means on said carriage operable with a to and fro movement for operating said latch and lifting said door, said operating means comprising a member in position to engage said toggle to lock the same, on movement of the operating means in one direction, and a pair of members in position thereon for one to first engage the toggle to unlock the same and the other to then lift the lifting lug to lift the door, on movement of the operating means in the opposite direction of its to and fro movement.

4. Apparatus as claimed in claim 3, and in which the toggle lock comprises a double arm center lock toggle.

5. A self-sealing coke oven door closure apparatus for a horizontal coke oven chamber with a doorway at one end of the chamber and a sealing surface around the margin of the doorway, comprising: an inner plug section; a rigid outer metallic supporting section; an intermediate flexible sealing member having an inwardly extending sealing edge extending around the margin of the door for sealing engagement with the sealing surface around the margin of the doorway; flexible means disposed around the margin of the door for adjusting the sealing edge to said sealing surface, oppositely disposed door retainer means mounted exteriorly of the door on opposite sides of the same; a latch bar spanning the door between the same and said oppositely disposed door retainer means for securing the door in, and releasing the

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door from, gastight relation between its said marginal sealing edge and the marginal sealing surface around the doorway; a toggle lock between said outer metal supporting sections of the door and said latch bar, said toggle lock having an arm thereof pivoted to said supporting section and another arm pivoted to said latch bar with a pivotal connection between the arms for effecting pressure movement of the door and latch from each other to secure them in place by the retainer means.

6. Apparatus as claimed in claim 5, and in which the toggle lock comprises a double arm center lock toggle.

7. A self-sealing coke oven door closure apparatus for a horizontal coke oven chamber with a doorway at one end of the chamber and a sealing surface around the margin of the doorway, comprising: an inner plug section; a rigid outer metallic supporting section; an intermediate flexible sealing member having an inwardly extending sealing edge extending around the margin of the door for sealing engagement with the sealing surface around the margin of the doorway; flexible means disposed around the margin of the door for adjusting the sealing edge to said sealing surface, oppositely disposed door retainer means mounted exteriorly of the door on opposite sides of the same; a latch bar spanning the door between the same and said oppositely disposed door retainer means for securing the door in, and releasing the door from, gas tight relation between its said marginal sealing edge and the marginal sealing surface around the doorway; a toggle lock between said outer metal supporting sections of the door and said latch bar, said toggle lock having an arm thereof pivoted to said supporting section and another arm pivoted to said latch bar with a pivotal connection between the arms for effecting pressure movement of the door and latch from each other to secure them in place by the retainer means, operating means operable with a to and fro movement for operating said latch, said operating means comprising a member in position to engage said toggle to lock the same, on movement of the operating means in one direction, and a member in position thereon to engage the toggle to unlock the same on movement of the operating means in the opposite direction of its to and fro movement.

8. Apparatus as claimed in claim 7, and in which the toggle lock comprises a double arm center lock toggle.

9. A self-sealing coke oven door closure apparatus for a horizontal coke oven chamber with a doorway at one end of the chamber and a sealing surface around the margin of the doorway, comprising: an inner plug section; a rigid outer metallic supporting section; an intermediate flexing sealing member having an inwardly extending sealing edge extending around the margin of the door for sealing engagement with the sealing surface around the margin of the doorway; flexible means disposed around the margin of the door for adjusting the sealing edge to said sealing surface, oppositely disposed door retainer means mounted exteriorly of the door on opposite sides of the same; a latch bar spanning the door between the same and said oppositely disposed door retainer means for securing the door in, and releasing the door from, gas tight relation between its said marginal sealing edge and the marginal sealing surface around the doorway; a

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toggle lock between said outer metal supporting sections of the door and said latch bar, said toggle lock having an arm thereof pivoted to said supporting section and another arm pivoted to said latch bar with a pivotal connection between the arms for effecting pressure movement of the door and latch from each other to secure them in place by the retainer means, a carriage movable alongside the oven chamber into and out of position for releasing and resealing the door relative to said chamber doorway, operating means on said carriage operable with a to and fro movement for operating said latch on said door, said operating means comprising a member in position to engage said toggle to lock the same, on movement of the operating means in one direction, and another member in position thereon to engage the toggle to unlock the same, on movement of the operating means in the opposite direction of its to and fro movement.

10. Apparatus as claimed in claim 9, and in which the toggle lock comprises a double arm center lock toggle.

11. A self-sealing coke oven door closure apparatus for a horizontal coke oven chamber with a doorway at one end of the chamber and a sealing surface around the margin of the doorway, comprising: an inner plug section; a rigid outer metallic supporting section; an intermediate flexible sealing member having an inwardly extending sealing edge extending around the margin of the door for sealing engagement with the sealing surface around the margin of the doorway; flexible means disposed around the margin of the door for adjusting the sealing edge to said sealing surface, oppositely disposed door retainer means mounted exteriorly of the door on opposite sides of the same; a latch bar spanning the door between the same and said oppositely disposed door retainer means for securing the door in, and releasing the door from, gastight relation between its said marginal sealing edge and the marginal sealing surface around the doorway; a toggle lock between said outer metal supporting sections of the door and said latch bar, said toggle lock having an arm thereof pivoted to said supporting section and another arm pivoted to said latch bar with a pivotal connection between the arms for effecting pressure movement of the door and latch from each other to secure them in place by the retainer means, a door lifting lug on the supporting section, a carriage movable alongside the oven chamber into and out of position for lifting and resealing the door relative to said chamber doorway, operating means on said carriage operable with a to and fro movement for operating said latch and lifting said door, said operating means comprising a member in position to engage said toggle to lock the same, on movement of the operating means in one direction, and a pair of members in position thereon for one to first engage the toggle to unlock the same and the other to then lift the lifting lug to lift the door, on movement of the operating means in the opposite direction of its to and fro movement.

12. Apparatus as claimed in claim 11, and in which the toggle lock comprises a double arm center lock toggle.

No references cited.