

March 25, 1941.

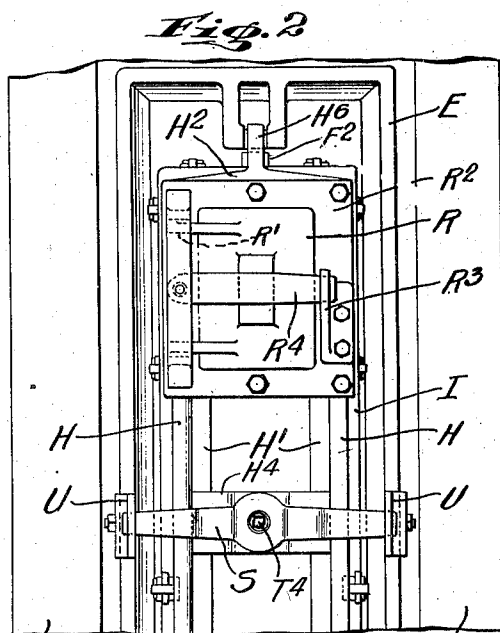
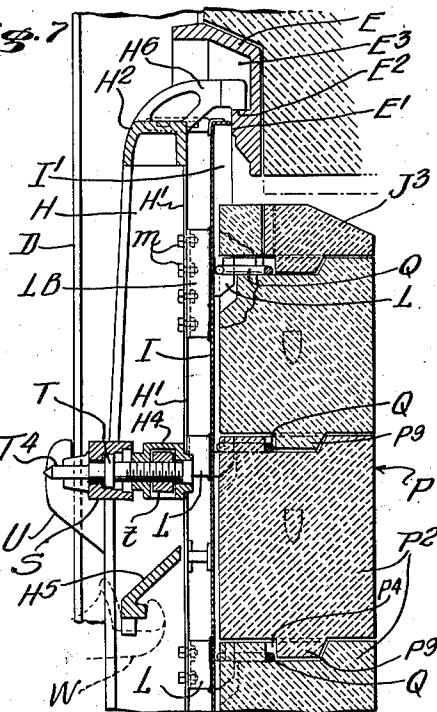
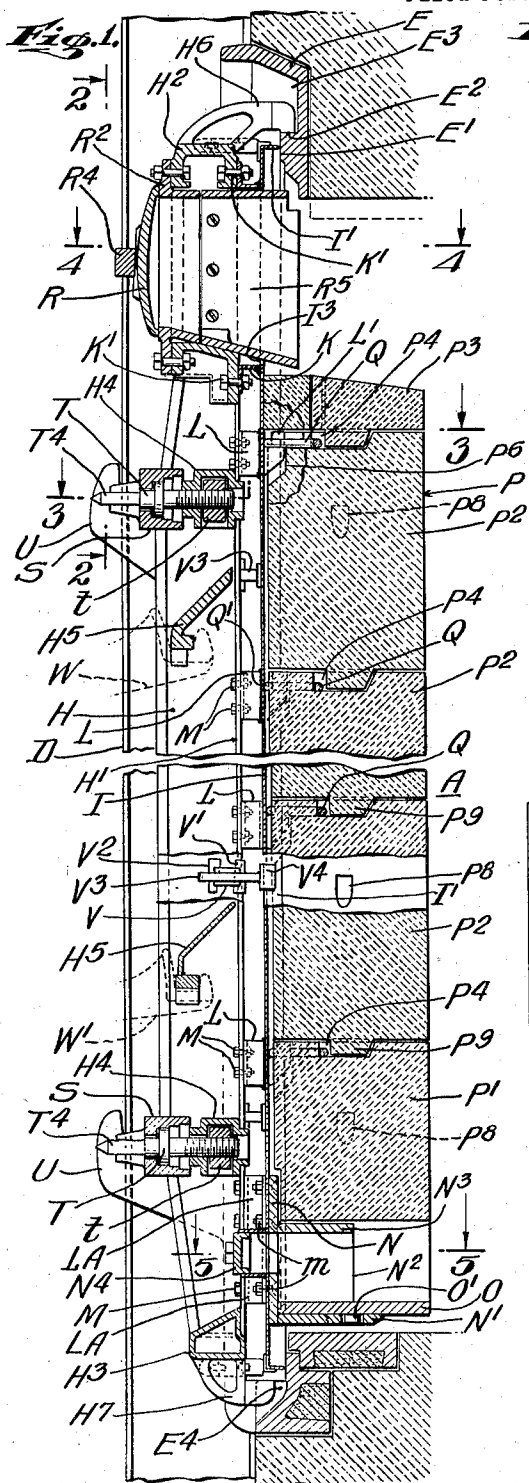
B. A. FREEMAN

2,236,092

COKE OVEN DOOR

Filed Feb. 9, 1939

3 Sheets-Sheet 1



INVENTOR *D*
BENJAMIN A. FREEMAN
BY
John E. Hubbard
ATTORNEY

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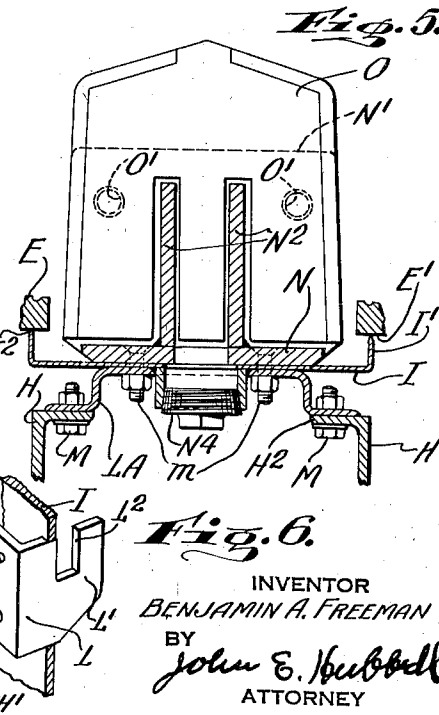
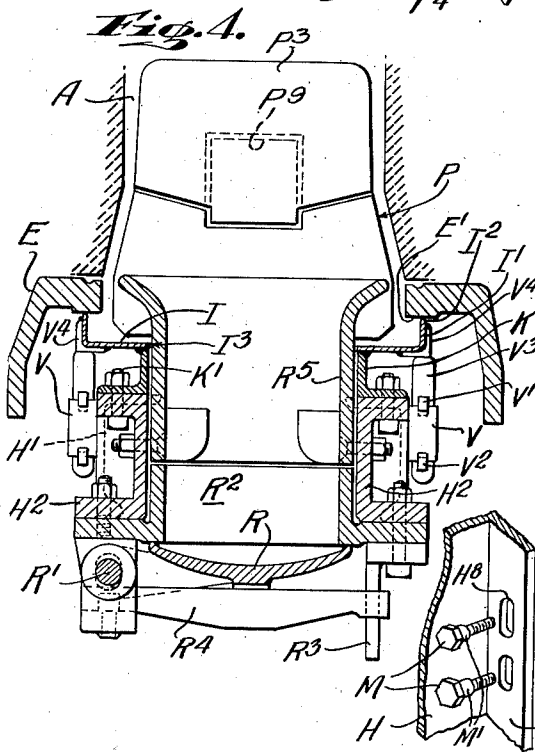
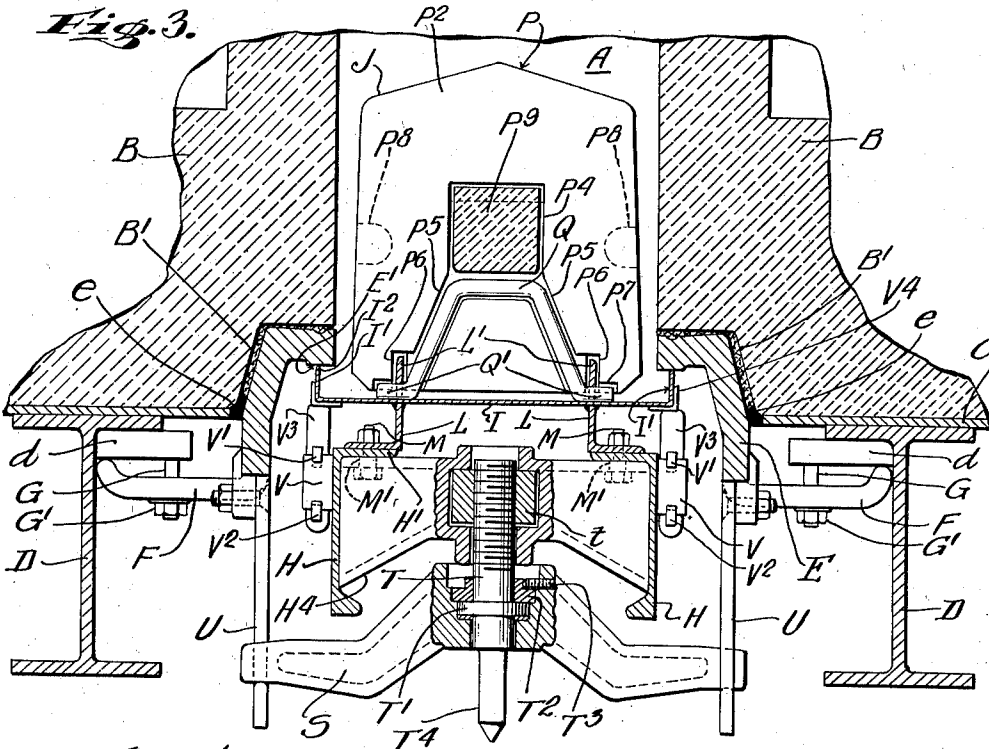
B. A. FREEMAN

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COKE OVEN DOOR

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3 Sheets-Sheet 2



INVENTOR
BENJAMIN A. FREEMAN
BY
John E. Hubbard
ATTORNEY

March 25, 1941.

B. A. FREEMAN

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COKE OVEN DOOR

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3 Sheets-Sheet 3

Fig. 11.

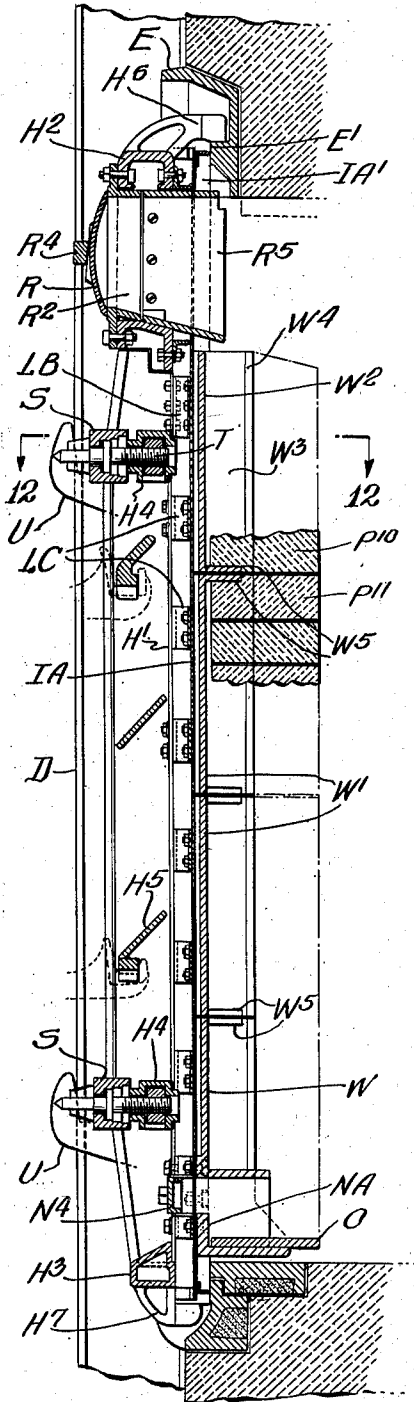


Fig. 12.

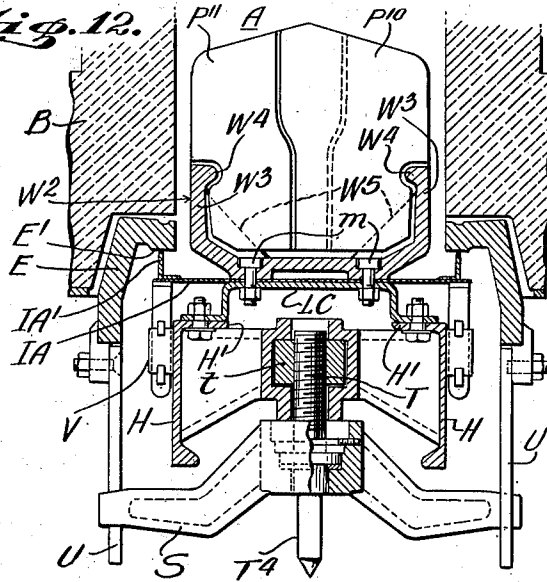


Fig. 8.

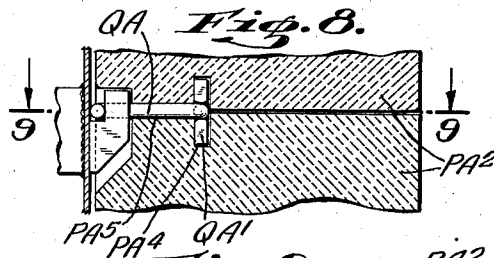


Fig. 9.

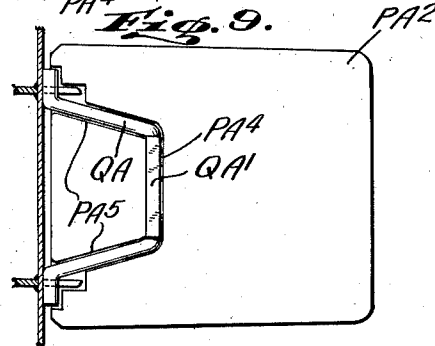
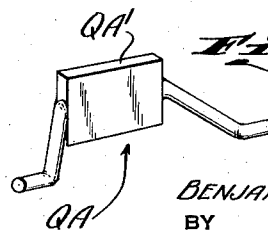


Fig. 10.



INVENTOR
BENJAMIN A. FREEMAN
BY
John E. Hubbard
ATTORNEY

UNITED STATES PATENT OFFICE

2,236,092

COKE OVEN DOOR

Benjamin A. Freeman, Montclair, N. J., assignor,
by mesne assignments, to Wilputte Coke Oven
Corporation, New York, N. Y., a corporation of
Maine

Application February 9, 1939, Serial No. 255,418

11 Claims. (Cl. 202—248)

The general object of the present invention is to provide improvements in plug type doors, and particularly self-sealing plug type doors, employed to close the ends of coking chambers of horizontal coke oven batteries.

The main object of the present invention is to provide a self-sealing plug type coke oven door, comprising a relatively rigid outer metallic section, an inner plug section and a flexible sealing section comprising a through plate interposed between the outer and plug sections and supporting the latter, in which each of the three sections is free to expand and contract in a vertical direction relative to each of the other two sections, but in which horizontal movement of the through plate relative to the outer section of the door, is restricted by connections, specially provided for the purpose, between the outer section and through plate. The specially provided connections act directly on portions of the through plate at a substantial distance inward from the marginal edge of the latter, and separate from the adjusting means acting between the outer section of the door and the marginal edge of the through plate, and employed, as is customary, to deform the sealing edge of the sealing action relative to the outer section in order that the sealing edge may be brought into conformity with a warped or distorted door frame sealing surface.

The use of the said special connections makes the inherent sealing section flexibility of the improved door seem less than that of certain known doors in which the major portion of the through plate is not positively held against horizontal movement relative to the outer section. However, it permits of a desirably greater inherent sealing section flexibility than exists in other extensively used doors, in which a flexible sealing plate member, which may or may not be a through plate, is rigidly clamped against a seat on the outer door section which, in practice, must be closer to the sealing edge, than are the portions of the through plate to which the special connections are made in accordance with the present invention.

The use of said special connections eliminates an objectionable tendency of the plug section of the door to wobble, or to assume an asymmetrical position relative to the outer door section, which exists in doors having greater inherent flexibility. In some cases, the use of the special connections may make it impossible to safely deform the sealing edge relative to the outer section, by adjustment of the usual adjusting provisions, to an extent sufficiently to bring the sealing edge into

engagement with the sealing surface of a distorted door frame, when the door is not subject to a substantial locking pressure. I have found however, that in such cases, the application to the door of a locking force of the usual magnitude, and applied in the manner now customary will bend a suitably constructed outer door section and thereby additionally bend the sealing edge, as required to bring the sealing edge into sealing engagement with the distorted door frame sealing surface.

A further object of the invention is to provide a coke oven door with an improved levelling bar doorway construction, and, in particular, to provide a self-sealing coke oven door including a flexible through plate interposed between the outer and plug sections of the door with a desirable form of levelling door bar construction attached to and supported by the outer door section.

Another specific object of the invention is to provide improvements in the plug sections of a plug type coke oven door and improvements in the means by which plug sections are supported from the through plates of self-sealing coke oven doors.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and various specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described preferred embodiments of the invention.

Of the drawings:

Fig. 1 is a vertical section through a pusher side coke oven door and the end of a coking chamber closed by the door, the section being taken on the longitudinal central plane of the coking chamber;

Fig. 2 is a partial side elevation taken on the plane indicated by the line 2—2 of Fig. 1;

Fig. 3 is a horizontal section on the broken line 3—3 of Fig. 1;

Fig. 4 is a horizontal section on the line 4—4 of Fig. 1;

Fig. 5 is a horizontal section on the line 5—5 of Fig. 1;

Fig. 6 is a perspective view illustrating details of construction;

Fig. 7 is a section taken similarly to Fig. 1 illustrating a coke side door;

Fig. 8 is a diagrammatic side elevation of a portion of a door of modified construction;

Fig. 9 is a plan view of a portion of the structure shown in Fig. 8;

5 Fig. 10 is a perspective view of a plug section supporting member employed in the door shown in Figs. 8 and 9;

Fig. 11 is an elevation taken similarly to Fig. 1, illustrating a modified door construction; and

10 Fig. 12 is a section on the line 12—12 of Fig. 11.

In the drawings, and referring first to Figs. 1-7, I have illustrated the use of my improved doors in a conventional type coke oven battery having horizontal coking chambers A, alternating with flued heating walls B, and in which the coke oven masonry is reinforced and supported at the sides of the battery by a metallic armor comprising a flash plate C at each heating wall end, and a corresponding vertical buckstay D by which the flash plate is held in place. At each end of each coking chamber, there is a one piece metallic cast metal door frame of generally rectangular form, and having an outwardly facing sealing surface E' which extends around the doorway. The heating walls at the opposite sides of each coking chamber are recessed at their vertical corners as indicated at B', to receive an inner portion of the corresponding door frame member, which is of substantial horizontal depth, and extends between the adjacent flash plates, and has an outer portion at the outer sides of said plates. In accordance with the present invention, the flash plates are spaced away from the sides of the door frame, to provide a joint of suitable width for the ready insertion, and replacement or tamping, when necessary, of packing material e, employed to make the joint gas tight.

As shown, each door-frame member E is anchored in place by adjustable clamping connections between its sides and the adjacent buckstay members D, of the character disclosed in the Wilputte Patent No. 2,025,967, granted December 1, 1935. Each such connection comprises a part d welded to the corresponding buckstay D, a clamping lever F, and a bolt G. One end of the lever F bears against an outer edge surface of the doorframe member E, and the other end of the lever bears against the corresponding part d. The bolt G has its head received in an undercut slot formed in the part d, and extends through the lever F, midway between the ends of the latter, and has a nut G' threaded on its outer end and bearing against the outer side of the lever F.

The coke oven door illustrated, comprises three main sections, namely, a relatively rigid metallic outer, or supporting section H, an inner plug section P and an intermediate relatively flexible sealing section comprising parts I and I'.

The outer section H, in the form shown, comprises main vertical side beam portions having web portions transverse to, and base portions H' parallel to the adjacent side of the battery in the closed position of the door. The said side beam portions are connected by upper and lower end portions H² and H³, respectively, and intermediate transverse portions H⁴ and H⁵, all of which may be welded to, or cast integrally with the side beam portions.

In the preferred form of the present invention, the door, when in its closed position, is supported by the door frame E through a suitable connection between said frame and the outer door section H. Advantageously, and as shown, that connection includes an integral hook extension H⁶ of the top member H², which engages a supporting shoulder E² forming the bottom wall of a

central outwardly facing recess E³ in the top portion of the frame E. As shown also, the lower end of the door is centered, when in its closed position, by an inwardly extending projection H⁷ from the bottom portion of the section H, which is then entered in an outwardly formed recess E⁴, formed centrally in the lower portion of the door frame.

In the form shown, the intermediate sealing section of the door is of the known type sometimes referred to as the "through plate" type, comprising a flexible metallic plate body portion I, which extends across the doorway and into overlapping relation with the sealing surface E', and which, in the closed position of the door, is engaged by a sealing rim or flange I' extending transversely away from the plate I at its periphery, and ordinarily having its sealing edge I² bevelled off or sharpened. As shown, the sealing rim I' and body plate I are integrally connected portions of sheet metal. In the closed position of the door, the sharpened edge I² of the sealing rim abuts against and makes a gas tight joint with the door frame sealing surface E', the latter ordinarily being a machined surface.

The sealing section I, I', which supports the plug section P as hereinafter described, is itself supported through a connection between the upper portions of the section H and the flexible body plate I. In the pusher side door construction illustrated in Figs. 1-6, the said supporting connection comprises a frame K at the outer side of the plate I, and surrounding the leveling bar opening I³ in said plate. As shown, the frame K is of angle bar cross section with one flange of the section transverse to the plate I, and the second flange parallel to and spaced away from said plate and rigidly secured by clamping bolts K' against the portion H² of the outer door section H. The flange of the frame K transverse to the plate I, is welded to the latter at the margin of the opening I³.

Below the connecting frame K, the sealing section plate I is connected to the outer door section by means which include a plurality of connecting parts L and which do not interfere with the thermal expansion in the vertical direction of the plate I relative to the section H. As shown, each part L is of angle bar cross section, with one flange parallel to, and held by bolts M against the inner side of an adjacent portion H' of the outer section H. The second flange portion of each member L extends transversely to the plate I and is welded to the latter. In the preferred construction illustrated, the last mentioned flange extends through an opening formed for the purpose in the plate I, and has a hook portion L' at the inner side of said plate, the plate I and the part L being welded together all along the margin of said opening. As shown, the members L are arranged in pairs at different levels and each intermediate the vertical center line of the plate I and its margin, and at a substantial distance from the latter so as not to objectionably interfere with the desired flexibility of the marginal portion of the sealing section.

To accommodate the relative vertical expansion of the lower portions of the plate I and section H, the connecting bolts M are shown as formed with enlarged portions or shoulders M' adjacent their heads which are received in vertical slots H⁸, formed in the flanges H', the portions of the bolts at the inner sides of the enlarged portions M' passing through and fitting snugly in holes formed in the members L.

The lower portions of section H and plate I

are connected by specially shaped metal plate parts LA, which are connected to the door section H by shouldered bolts M just as are the parts L, and which have one flange alongside and in contact with the plate I and connected to the latter by ordinary bolts *m*. The bolts *m* also extend through a vertical plate portion N of a plug section supporting member. That member comprises in addition to the plate N, a horizontal bottom plate N', a pair of vertical plates N² and an upper horizontal plate N³. The different parts N, N', N² and N³ are welded together. The vertical plates N² and top plate N³ serve not only to stiffen the bottom plate N' and to strengthen its connection to the plate N, but also form the side and top walls of the burner passage customarily provided in the lower portion of such a coke oven door, to permit a gas burner to be extended into the oven chamber during the initial heating up of the battery. After the initial heating up of the oven, the inner portion of the burner passage is ordinarily closed by refractory material, and the outer portion of the passage is closed by a plug N⁴.

As shown, the plate N' does not extend inwardly to the inner side of the plug section of the door, but supports a cast metal plate like part O, which may extend to the inside of the plug section. The part O is slotted to receive the vertical plates N², and is formed with projections O' at its lower side, which extend into openings formed for the purpose in the bottom plate N', and thus hold the plate O against horizontal displacement relative to the plate N'. As shown in Fig. 1, the plug section of the door comprises superposed bodies P', P² and P³ of refractory material. While each of said bodies may be formed of a plurality of fire bricks or blocks suitably connected together, I now consider it preferable to have each body in the form of a monolithic mass of suitably refractory concrete, which ordinarily does not require metallic reinforcing.

The lower body P' rests at its lower end on the plate O and is formed with a burner passage recess within which the support plates N² and N³ are received. At its upper end, the body P' is formed with a central shallow recess or socket P⁴, of rectangular outline and with inclined, horizontally disposed channel like extensions P⁵ running to the outer side of the plug section. At its outer side, the body P' is also formed with vertical recesses P⁶ and P⁷. The two recesses P⁶ receive the hook portions L' of a corresponding pair of members L. The two recesses P⁷ receive the oppositely extending ends Q' of retaining member Q formed by bending a metal rod into the form of a yoke. The ends Q' pass through the hook notches L² of the corresponding pair of hook portions L', and the leg portions of the member Q are received in the corresponding channels P⁵, and the central connecting portion of the member Q is within the recess P⁴ and adjacent the vertical outer wall of that recess. The rod Q thus forms a locking yoke or bail which normally extends about the upper portion of the body P' lying at the outside of the recess P⁴ and between the channels P⁵, and thus holds the upper end of the body P' against significant horizontal movement relative to the plate I. To facilitate its manipulation in assembling and disassembling the door the body P' is shown as formed with recesses P⁸ in its opposite sides, for engagement by joist hooks or lifting means.

In the assembled door, the central top recess P⁴ of the lower section P' receives an integral

tenon like projection P⁹ from the underside of the adjacent intermediate section P². There are three in the particular door form shown in Fig. 1, all of which may be exactly alike. As shown, each intermediate section P² has a projection P⁹ at its lower end, and is formed at its upper end exactly like the lower section P', and is normally engaged at its upper end by a corresponding locking yoke member Q. The top section P³ of the pusher side door shown in Fig. 1 is made in two separate parts, and forms a refractory cover for the corresponding subjacent recess P⁴ and locking member Q, and has its upper side inclined downwardly and located sufficiently below the path of movement of the levelling bar for clearance purposes.

Associated with the levelling bar opening in each coke side door is a levelling bar doorway structure comprising normally closed door R, which is hinge connected by vertical pintle means R' to an outer leveller bar door frame member R². The latter is bolted to the top portion H² of the outer door section, and is provided with a retaining hook R³, for engagement by a pivoted locking bar R⁴ by which the door may be detachably secured in its closed position. The member R² surrounds the outer portion of the leveller bar passageway and is in end to end relation with a hollow member R⁵ extending through the sealing plate opening I³, and bolted to the top portion H². In the preferred construction illustrated, the inner edges of the vertical sides of the part R³ are flared away from one another so as to substantially shield the portions of the sealing plate I alongside the levelling bar opening, against radiant heat from the coking chamber and against contact with the flames, passing toward and through the levelling bar doorway during the charge levelling operation. The bottom wall of the part R⁵, like the bottom wall of the part R², is downwardly inclined and shields the portion of the plate I below the leveller bar opening and above the plug top section P³, against the absorption of radiant heat from the oven. Said bottom wall inclination also minimizes the extent to which coal is moved out of the levelling bar opening in the charge levelling operation, and permits tar condensing in the doorway structure to drain back into hotter portions of the oven.

The door is adapted to be locked in its closed position and the proper sealing pressure established, by means of locking bars S at the outer side of the outer door section, and adapted to engage the inner side of the door retaining hooks U connected to the door frame, and means creating a force acting between the door section H and each locking bar in a direction to move them apart. For the purposes of the present invention, it is immaterial whether the locking force is due to spring action, as it is in the case of some doors now in use in this country of the general type shown, for example, in the Potter Patent No. 2,157,569 granted May 9, 1939, on an application, filed June 12, 1937, or is due to the more extensively used nut and screw connection between the outer door section and locking bars, one form of which is illustrated in Fig. 3. As shown in that figure, each locking bar is mounted on the outer door section H, by means of a corresponding locking spindle or screw T, on the outer end of which the locking bar is swivelled. As shown the spindle extends through the locking bar and is formed with a collar T', bearing at its outer end against an integral portion of

the locking bar and at its inner end against a collar T², removably secured in the locking bar as by a set screw T³. The threaded inner body portion of each spindle T, is threaded through a nut t mounted in the corresponding intermediate portion H⁴ of the outer door section. As will be apparent, when either locking bar spindle T is rotated in one direction, it tends to move the corresponding locking bar away from the door. Such rotation of the spindles T, when the ends of each of the locking bars are in engagement with the corresponding door retaining hook projections U, from the door frame E, is thus adapted to force the door inward and establish the proper sealing pressure between the door frame surface E' and door sealing rim I', and locks the door in its closed position. Rotation of the spindles T in the opposite direction, relieves the sealing pressure and unlocks the door. For engagement by an operating wrench, or power driven spindle, the outer end portion T⁴, of each spindle T, may be squared.

The sealing member is directly supported and has its marginal portions held at the proper horizontal distances from the outer section of the door, by so-called adjusting connections. The latter may be of various known forms, and, as shown, each comprises a pair of vertically adjustable wedges V' and V² engaging the inner and outer edges, respectively of a corresponding projection or projections V from the rigid outer door section H, and each acting between said projections and the corresponding end of a slot formed in a thrust bar part V³. The latter may thus be horizontally adjusted in the direction of its length, by vertical adjustments in opposite directions of the two corresponding wedges V' and V². As shown, each part V³ bears at its inner end against a pad V⁴ welded to the outer side of the plate I adjacent its margin. The adjusting connections illustrated were not invented by me, but by Joel Sanford Potter, and are illustrated and described in his above mentioned application.

The upper of the two intermediate portions H⁵ of the outer door section is shaped for engagement by a door lifting hook W of a door machine, and the lower intermediate portion H⁵ is shaped for engagement by a door machine hook W', which in the door removing operation, customarily takes no part of the weight of the door, but holds the door against movement relative to the lifting hook W, while the latter is in operative engagement with the door.

The door construction illustrated in Figs. 1 to 6 is characterized by its relative mechanical simplicity and durability, and by the comparative ease with which it can be assembled, and disassembled when necessary for repairs. The door is operatively characterized not only by the simplicity and effective character of the provisions for establishing a door sealing pressure per door as great as conditions may make desirable, but also by the avoidance of stress conditions tending to weaken the door and shorten its effective life. The plug section parts P', P² and P³, may freely expand and contract in response to changes in temperature without creating any adverse reaction on one another or on the other sections of the door. Each of the three main door sections H, I, I' and P is substantially free to expand in the vertical direction relative to each of the other sections, which is especially important because of their construction and the

different temperature conditions to which they are subject.

With the weight of the plug section carried by the sealing plate I through a plug section support secured to the lower end of the plate, and with the sealing plate suspended from the upper portion of the rigid outer section as described, the transfer of the weight of the door between the door frame shoulder E² and the door machine hook W, involves no significant change in direction or magnitude of the gravitational stresses to which the sealing and plug sections of the door are subject.

For a full appreciation of the advantages of the above described door construction, account should be taken of the considerable dimensions and heavy weight of coke oven doors and the high temperatures to which they are subjected. Such a coke oven door is seldom less than 12 feet, and may be more than 15 feet, high, and its weight is ordinarily in the neighborhood of two and one-half tons. The refractory plug section material is normally incandescent, and it may attain a temperature appreciably in excess of 2,000° F. While the temperature of the metallic sealing section is necessarily very much lower, it is normally not much below the maximum which the sealing section metal can safely withstand, and the spacing of the sealing plate I away from the outer side of the plug section reduces the rate of heat transfer to the plate, contributes to a suitable low plate temperature.

The major portion of the coke oven door weight is that of the plug section refractory material, and there is an objectionable tendency, avoided in a door constructed as described above, for the plug section to wobble and to work into an undesirable asymmetrical position relative to the outer section of the door, when the weight of the plug section is supported by a through plate, the major portion of which is not directly restrained against movement relative to the outer section of the door, by means like, or equivalent to, those including the previously mentioned connecting parts L.

While ordinarily, the different door frames of a coke oven battery differ in the extent and character of the distortion which they develop in use, in general, the major deformation of each door frame, is an inbowing of the vertical side portions of the frame. After a few weeks or months of regular operation, the extent of this bowing is such that at a level midway between the top and bottom of the door, the sealing surface E' of a door frame E of the character shown, may be displaced inwardly away from the plane including the upper and lower horizontal portions of the sealing surface, by a distance which ordinarily is about a quarter of an inch, but sometimes is as much as three-eighths of an inch.

A corresponding deformation of the sealing edge I² relative to the outer door section H, cannot be effected without serious risk of injuring the through plate, when the latter is connected to the outer door section by arms L and LA. I have found, however, that substantially more, perhaps twice as much, deformation of the sealing edge, is safely obtainable by bending an outer door section of suitable construction, and thereby bending the sealing section, as is safely obtainable by bending the sealing section without correspondingly bending the outer door section.

In the ordinary contemplated use of my improved door, therefore, the wedges V' and V², will be adjusted to effect a fraction only of the sealing

edge deformation required to bring the sealing edge I² into suitable engagement with the sealing surface E', prior to the subjection of the door to the normal locking force. With the wedges so adjusted, the application of the normal locking force will bend the outer door section, if of normal or suitable stiffness, as much as is needed for the total sealing edge deformation required.

While an outer door section of suitable dimensions and form is customarily regarded as rigid, and properly so for many purposes the outer door section is in effect a beam which will deflect to a substantial extent when subjected to a loading of the magnitude of the door locking force of thirty thousand pounds or so per door, now employed and considered proper and readily obtainable with the door construction illustrated.

The coke side door shown in Fig. 7 differs in principle from the pusher side door shown in Figs. 1-6, only in that it has no leveller bar opening and associated doorway structure. As shown, the flexible plate I of the coke side door is suspended from the upper portion of the outer door section H, through parts LB, which are located at about the same elevation as the frame K of the pusher side door, and are welded to the plate I, and are positively clamped to flange portions H' of the section H by ordinary clamping bolts m. As shown the members LB are formed with hook portions L' in which the corresponding locking yoke is mounted. The plug section bodies P¹, P² and P³ of the coke side door, may be exactly like the corresponding parts of the coke side door, except that since the plug section is taller in the coke side door than in the pusher side door, there may well be one more intermediate body P² in the coke side door than in the pusher side door. In the particular door designs shown in Figs. 1-7, the coke side door has three intermediate bodies P², and the pusher side door has two. In each door, each intermediate body P² is about thirty inches tall.

With the plug section construction shown in Figs. 1 and 2, the two upper and lower ceramic bodies P² meeting at a joint at which a member Q enters the plug section column, are interlocked against the horizontal movement of any one relative to either of the other two. As shown in Figs. 1 and 2, this result is secured by directly interlocking the member Q with the lower of the two bodies P², and by directly interlocking the two bodies P² with one another. As will be apparent, however, the same general interlocking result can be obtained in other ways, one of which is illustrated, by way of example, in Figs. 8, 9 and 10. In those figures a metallic retaining member QA, serving the purpose of the previously described member Q, is arranged to directly interlock with the two plug section bodies PA² which meet at the joint at which the member QA is located and which are not shaped to directly interlock with one another. The member QA, which may be made of wrought steel or may be a semisteel casting, is of yoke form, and has the base portion, QA', of the yoke, in the form of a vertically extending plate with an upper portion above, and a lower portion below the leg portions of the yoke. The lower body PA² is formed with grooves PA⁵ in its top surface and with a deeper connecting recess portion PA⁴, which receive the lower half of the member QA, and the upper body PA² is formed with grooves and a connecting recess portion, which are counterparts of those formed in the lower body and receive the upper half of the member QA.

The general type of plug section and mounting hereinbefore described has numerous special advantages. A refractory plug section column composed of four or five superposed monolithic masses very simple and relatively inexpensive in construction, and the monolithic masses are small enough to indefinitely withstand the cracking and disintegrating tendency of the temperature conditions to which they are subjected, and which sooner or later would be apt to result in the destruction, or serious deterioration, of substantially longer monolithic masses. The simple manner in which the superposed bodies are interlocked with one another and with the metallic supporting members entering the plug section from its outer side, is effective, and facilitates the assembly of the plug section, and its disassembly when necessary, and imposes no restraint on the relative expansion and contraction of each pair of superposed bodies and the metal part with which they are interlocked.

The plug section formed of superposed refractory bodies interlocked as described, has ample stability, particularly since, as those familiar with the operation of coke oven batteries will understand, there is practically no need to ever tilt such a coke oven door out of a general vertical position in normal operation. When an extensive door repair or rebuilding operation is necessary, it is a comparatively simple matter to remove the superposed blocks, one at a time at the beginning of the operation, and to replace those blocks at the end of the operation.

However, the general advantages of the type of door illustrated in Figs. 1-10, and not pertaining to the construction of the plug section, are obtainable with doors including other plug section constructions, one of which is illustrated in Figs. 11 and 12. In the last mentioned figures the refractory plug section material is in the form of bricks or blocks which are supported by the through plate IA of the door in an advantageous manner. Except in respect to its plug section and supporting means, the door shown in Figs. 11 and 12, need not differ in any essential respect from that shown in Figs. 1-6. As shown, however, the connections between the through plate IA of Figs. 11 and 12 and the outer and plug section of the door tend to less inherent through plate flexibility, than is obtainable in the door constructions previously described, and to compensate for this difference, the plate IA may advantageously be made somewhat thinner than the plate I. The latter, for example, may well be made of sheet steel three-sixteenths of an inch thick, while the plate IA may well be made of sheet steel one-eighth of an inch thick, though the plate thickness may be greater or less with either construction. With the thinner plate IA, the sealing rim IA' may well be of angle bar cross section, as shown, with one flange transverse to, and the other alongside, and welded to the plate IA.

In Figs. 11 and 12, a one piece device LC replaces each pair of side by side arms L located at the same level in the construction first described. Each of the devices LC is of a U-shape, and has its portion alongside, and its leg portions extending away from the plate IA. Each leg terminates in a transversely bent end portion alongside and connected to a portion H' of the outer section H. Each leg portion of the device LC, with its transversely bent end portion, the plate may thus be practically identical

in form with the portion of each supporting member L extending away from the plate I, at the outer side of the latter.

In the arrangement shown in Figs. 11 and 12, each of the plug section ceramic material courses is shown as composed of one wide brick or block P¹⁰ and one narrower brick or block P¹¹, arranged side by side, and with the joint between them extending in the general direction of the axis of the door, though the joint is advantageously at one side of said axis and curved as shown. The blocks P¹⁰ and P¹¹ in adjacent courses are reversed, so that the joint between the two bricks in each course is horizontally displaced from the joint between the two bricks of each adjacent course.

A considerable portion of the weight of the plug section brickwork is borne by the bottom support NA which extends under the column, but a portion of the weight of the bricks is borne by superposed cast iron brickholders, comprising a lower brickholder W, intermediate brickholders W' and an upper brickholder W². The bottom support NA is an integral portion of the lower brickholder W. Each of the brickholders is trough shaped in cross section, with the sides W³ of the trough at opposite sides of the outer portion of the brickwork column. Each trough side is formed at its edge with an inwardly extending rib W⁴, which extends into recesses provided for the purpose in the outer side edges of the corresponding bricks or blocks P¹⁰ and P¹¹, and thus interlocks the latter with the brickholder. Each of the brickholders is connected to and independently supported by the through plate. As shown, each brickholder is connected at an upper level to one, and at a lower level to a second of the previously mentioned connecting members LC, by clamping bolts m which extend through the interposed through plate and rigidly clamp the latter between the corresponding brickholders and parts LC.

Each of the intermediate brickholders W', is formed at each end with two horizontal web portions W⁵ shown as triangular in form and extending between the side and flat bottom portions of the brickholder. The lower and upper brickholders W and W² are formed with similar web portions only at their upper and lower ends, respectively. These web portions W⁵ extend into the brickwork, and support a portion of the weight of the latter, but, in general, a portion of the weight of the brickwork at the upper levels, as well as at the lower levels, is supported by the bottom support NA. As will be apparent with the plug section brickwork supported and arranged as shown, the relative expansion and contraction of the brickwork, brickholders, and the through plate are accommodated without subjecting any of the parts to disruptive stresses.

While in accordance with the provisions of the statutes, I have illustrated and described the best forms of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A self-sealing coke oven door comprising in combination, a relatively rigid metallic outer section, an inner plug section, a sealing member comprising a flexible through plate interposed between said outer and plug sections, supporting means secured to said plate through which the latter supports the weight of the plug section, a connection beneath the upper portions of said plate and outer section through which the latter supports the weight of the plate and plug section, connections between said outer section and vertically distributed portions of said plate below the first mentioned connection and between and displaced from each of the two side edges of the plate and adapted to oppose horizontal movement and to permit vertical movement of said distributed portions relative to said outer section, and adjusting means acting between said outer section and the portions of said plate distributed along the margin of the latter.

2. A self-sealing coke oven door as specified in claim 1, in which the said connections to the vertically distributed portions of the through plate, are arms secured to and extending outwardly away from the plate and in which each arm is connected to said outer section by a bolt extending through parts of said arm and outer section one of which parts is formed with a vertical slot through which said bolt extends.

3. A self-sealing coke oven door as specified in claim 1, in which the outer section comprises plate-like portions at its innerside generally parallel to said through plate and in which the said connections to vertically distributed portions of the through plate are arms secured to and extending outwardly away from the plate and each having a transversely bent outer end portion and in which each arm is connected to the outer section by a bolt extending through the transversely bent portion of the arm and through the said plate-like portion of the outer section and in which one of those portions is formed with a vertical slot through which the bolt extends.

4. A self-sealing coke oven door as specified in claim 1, in which a leveller bar opening is formed in the through plate adjacent its upper end and in which a levelling bar door frame structure, including a portion extending through said opening, is rigidly connected to said outer section and to said plate at the margin of said opening.

5. A self-sealing coke oven door as specified in claim 1, in which the said connections to the vertically distributed portions of the through plate comprise arms extending through and welded to said plate and comprise hook portions at the inner side of said through plate adapted for engagement with plug section supporting means.

6. In a plug type self-sealing coke oven door, the combination with a plug section comprising a column of superposed separable bodies of refractory material, of supporting means comprising a part extending beneath said column and supporting the weight of the latter, and a metallic member mechanically connected to said supporting means, and extending into the column from the outer side of the latter at the joint between two superposed bodies, the body ends adjacent the joint being shaped to provide a recess space receiving said member and to provide shoulders which in conjunction with said member interlock each of the two bodies and said member against relative horizontal movements, said recess having its top wall formed by the upper one and its bottom wall formed by the lower

one of said two bodies, whereby said member may be extended into and removed from said recess when the two bodies are vertically separated.

7. In a plug type self-sealing coke oven door, the combination of a plug section comprising a column of superposed separable bodies of refractory material, the adjacent ends of adjacent upper and lower bodies being relatively shaped to interlock the two bodies against relative horizontal movement and to provide a recess space with its top and bottom walls formed by the upper and lower bodies respectively, and metal supporting means including a part extending beneath and supporting the weight of the column and including a metallic member extending into said column from its outer side and having a portion within said recess and held by the recess walls against horizontal movement relative to said column.

8. In a plug type self-sealing coke oven door, the combination of a plug section comprising a column of superposed separable bodies of refractory material and having registering recesses formed in the adjacent ends of adjacent upper and lower bodies, and metal supporting means including a part extending beneath and supporting the weight of the column and including a metallic member comprising upper and lower portions respectively received in the recesses in said upper and lower bodies.

9. A coke oven door as specified in claim 6 in which the said recess space extends about a portion of one of said bodies adjacent the outer side of the column and in which the member entering said recess is in the form of a bail extending about said body portion.

10. A coke oven door comprising a relatively rigid metallic outer section and an inner plug section and a sealing member comprising a relatively flexible through plate interposed between said outer and plug sections, plug section supporting means secured to the bottom of said plate and extending beneath the plug section and through which the weight of the latter is supported by said plate, a connection between the

upper portions of said plate and outer section through which said plate is supported and vertically distributed connections between said plate and outer section below the first mentioned connection, each of said distributing connections including a part rigidly secured to said plate intermediate and at a substantial distance from each of the two vertical side edges of the plate and means connecting said part to the outer section preventing their relative movement in a horizontal direction and permitting relative movement in a vertical direction.

11. In a self-sealing coke oven door, the combination of a beam-like metallic outer section, an inner plug section, a sealing member comprising a relatively flexible through plate interposed between said outer and plug sections, supporting means secured to said plate through which the latter supports the weight of the plug section, a connection between the upper portions of said plate and outer section through which the latter supports the weight of the plate and plug sections, other connections between said outer section and plate engaging vertically spaced apart portions of the plate below the first mentioned connection and between and displaced from each of the two side edges of the plate and opposing movement of said portions toward and away from said outer section, adjusting connections between said outer section and portions of said plate distributed along the margin of the latter, and means acting on said outer section to press said sealing member against, and into sealing engagement with a door frame, and adapted to subject said outer section to upper and lower sealing forces at levels respectively below the top and above the bottom of the door, and of magnitudes sufficient to bend said outer section and thereby bend said sealing member into engagement with said sealing surface at points intermediate the top and bottom of the door, when but for such bending action, the sealing member would engage the sealing surface only adjacent the top and bottom of the door.

BENJAMIN A. FREEMAN. 45