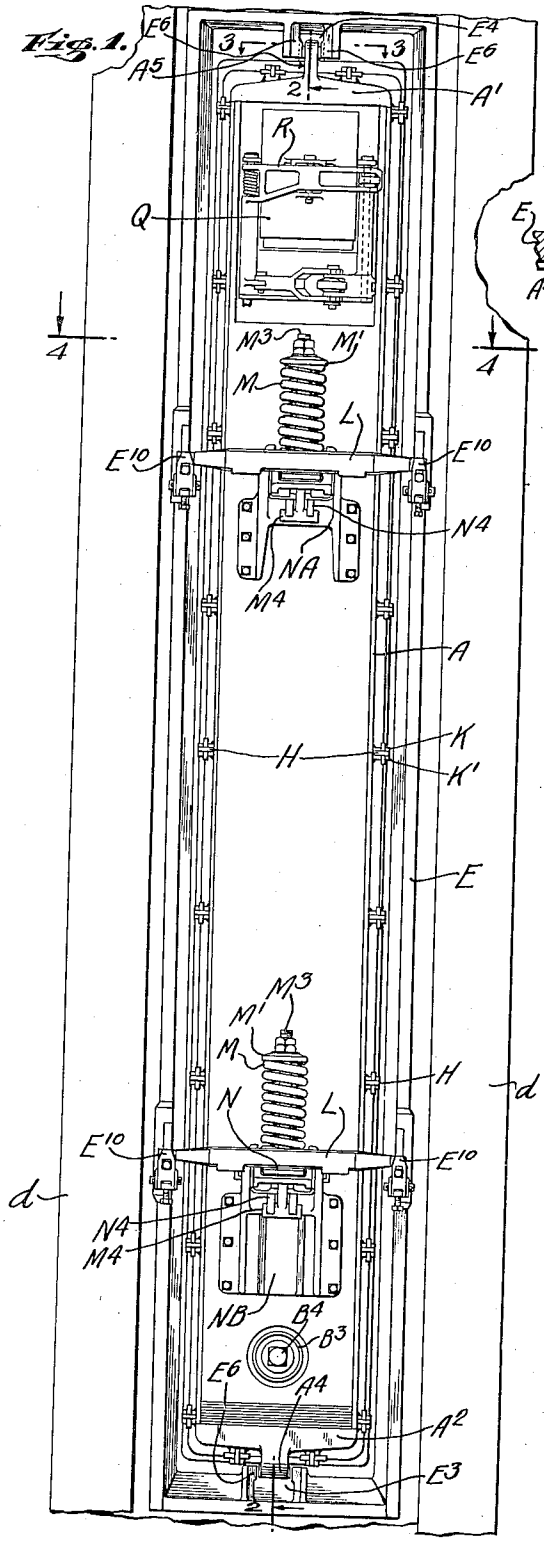
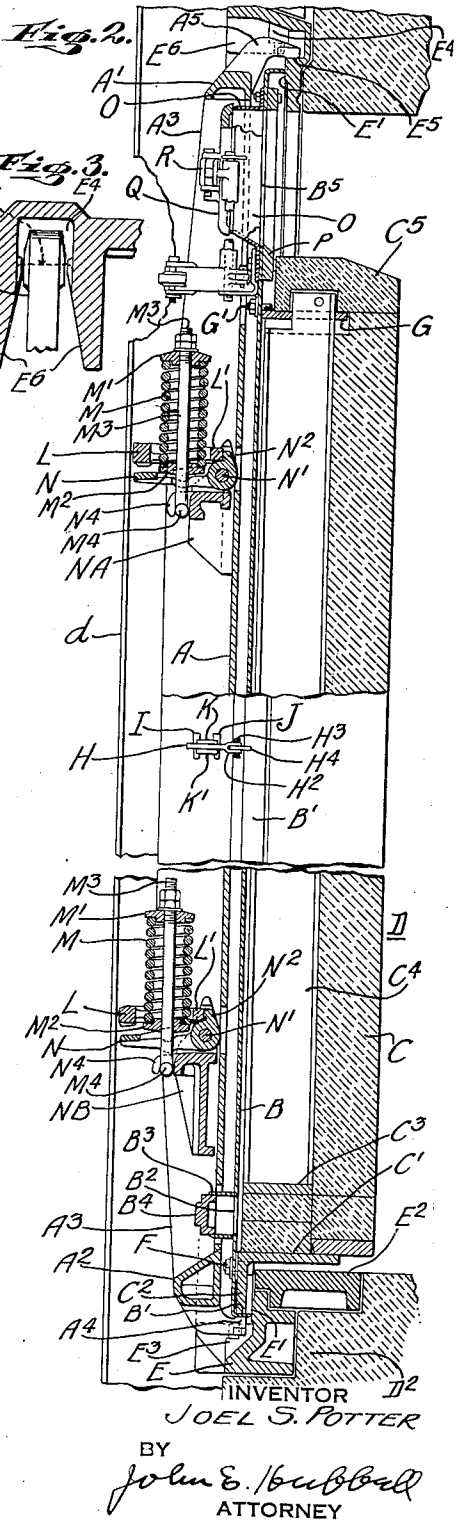
May 9, 1939. J. S. POTTER 2,157,569

SELF-SEALING COKE OVEN DOOR

Filed June 12, 1937 3 Sheets-Sheet 1





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SELF-SEALING COKE OVEN DOOR

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Fig. 3.

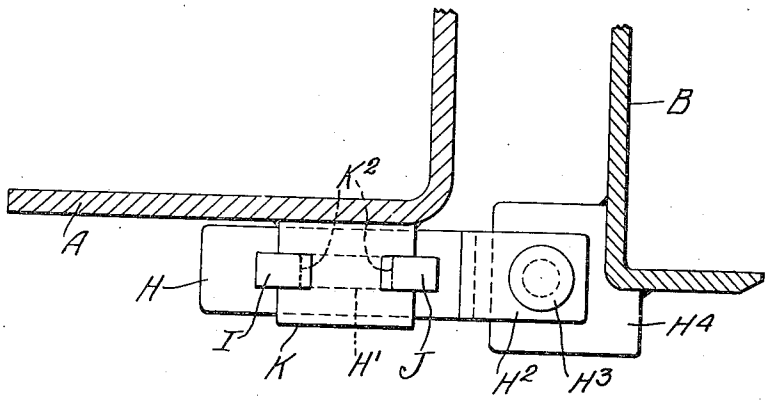
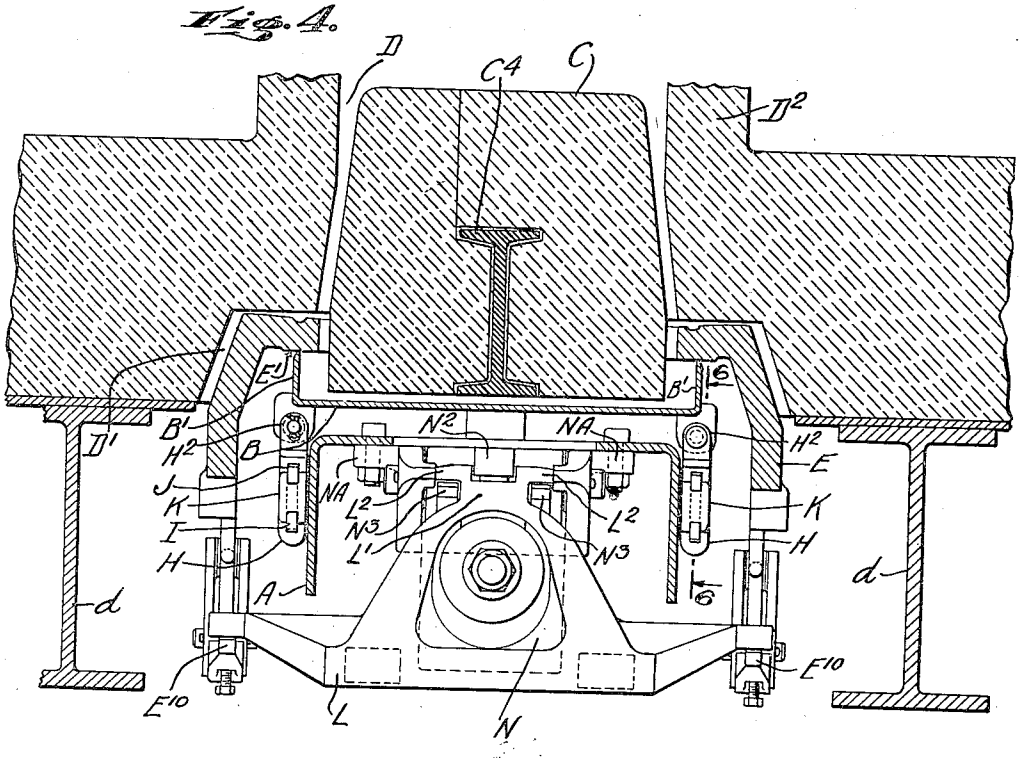


Fig. 4.



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Fig. 6.

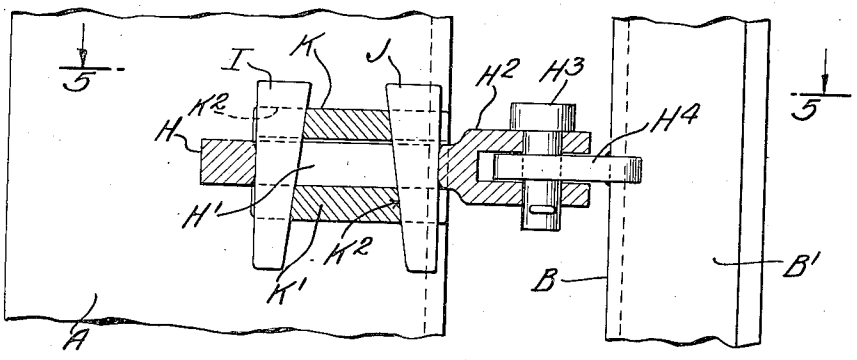


Fig. 7.

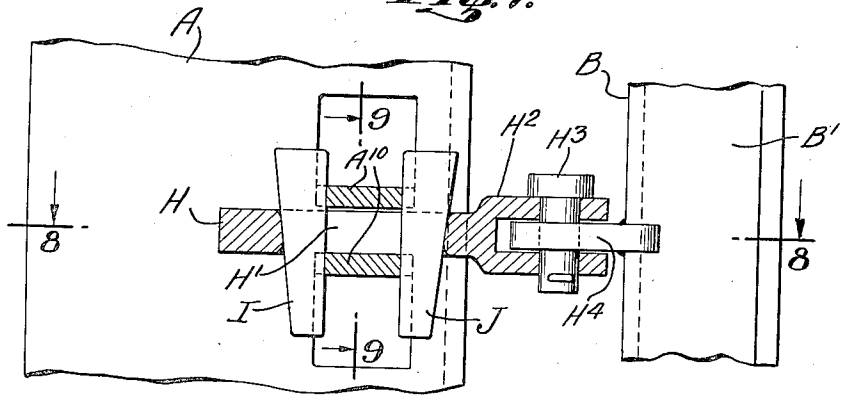


Fig. 9.

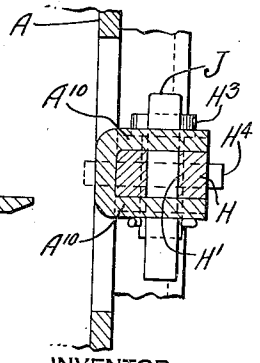
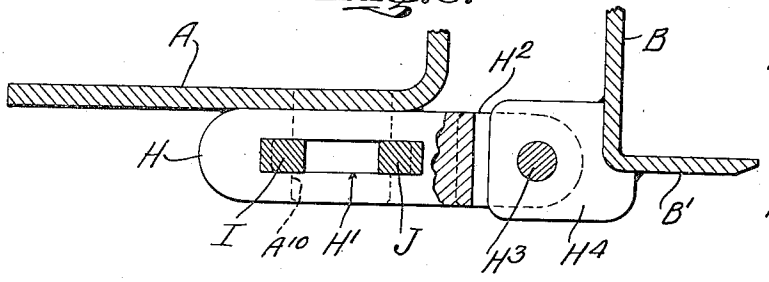


Fig. 8.



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Patented May 9, 1939 2,157,569

UNITED STATES PATENT OFFICE

2,157,569

SELF-SEALING COKE OVEN DOOR

Joel Sanford Potter, West Nyack, N. Y., assignor to Louis Wilputte, New Rochelle, N. Y.

Application June 12, 1937, Serial No. 147,878

8 Claims. (Cl. 202—248)

The general object of the present invention is to provide an improved end closure for a horizontally elongated coking chamber of the type employed for the production of metallurgical coke. A somewhat more specifically stated object of the invention, is to provide improvements in the construction of a plug type self-sealing coke oven door, and in the means for guiding the door into and supporting it in its normal position.

All plug type self-sealing coke oven doors now in use, of which I have knowledge, are alike, in that each includes a flexible sealing member part of sheet steel which overlaps a sealing surface on the doorframe surrounding the doorway closed by the door and into which the plug section of the door extends, and in that the door includes connections between a rigid outer section of the door and said flexible part, which are adjustable to bend and deform the flexible part as required to bring its contour into conformity with that of the doorframe sealing surface. In some self-sealing doors the said flexible part is a through plate interposed between the plug section and outer section of the doors and of itself forming a complete barrier to gas flow into or out of the oven through the doorway closed by the door. In other self-sealing doors, the said flexible part is attached to and forms a lateral extension from a rigid portion of the door uniting with the flexible part to provide the barrier to gas flow into and out of the oven chamber.

A specific object of the invention is to provide improved connections adjusting the said flexible sealing part of a door of the above mentioned kind. Heretofore the adjusting connections employed have been threaded connections, or so-called clamping screws, parallel to the oven axis and distributed along the marginal portion of the door. In accordance with the present invention I employ wedge connections in lieu of the previously used threaded connections, and thereby effect the necessary sealing member adjustments in a simpler and, less expensive and more advantageous manner.

Another specific object of the invention is to simplify and cheapen the cost of construction of the rigid outer door section, which in the preferred form of the invention comprises a body portion consisting of a rolled steel beam of channel bar cross section, and cast steel top and bottom end portions welded to the ends of said beam.

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 specific objects attained with its use reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a side elevation of a portion of a coke oven battery structure including a self sealing door constructed in accordance with the present invention;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a partial horizontal section on the 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. 6;

Fig. 6 is a partial section on the line 6—6 of Fig. 4;

Fig. 7 is a view taken similarly to Fig. 6, illustrating a modified construction;

Fig. 8 is a partial section on the line 8—8 of Fig. 7; and

Fig. 9 is a partial section on the line 9—9 of Fig. 7.

The coke oven end closure shown in the drawings, includes a removable plug door comprising a rigid outer metallic section A, a flexible metallic sealing section B, and an inner plug section C. The latter, which consists largely of ceramic material, in the closed position of the door extends into and forms a stopper or plug substantially filling one end of a coking chamber D, at the margin of which is located a rigid metallic door frame member E. Ordinarily, and as shown, the latter extends into a recess D', formed in the coke oven brickwork D^2, and surrounds and forms a metallic lining for, the mouth or doorway portion of the coking chamber. The door frame member E is suitably anchored in place in the coke oven masonry. The anchoring means, not shown in the drawings, may comprise detachable connections between the door frame member E and the buckstays *d* at the ends of the heating walls, as disclosed in the Wilputte Patent No. 2,025,967, granted December 31, 1935. The door frame member is formed with a sealing surface E' transverse to the oven axis, and extending about the doorway. At the bottom of the oven, the door frame member E engages and provides support for a metallic door sill member E^2. The door frame E is also formed with upper and lower door positioning parts, as hereinafter described.

The rigid outer door section A may be a metal casting, but, advantageously, and as shown, it comprises a heavy rolled channel bar body portion, and cast steel top and bottom members A' and A^2 welded to the ends of said body portion. To minimize the door weight, end portions of the flanges of the channel bar body portion may be beveled off as indicated at A^3.

The sealing member B, in the particular form illustrated, comprises a plate of sheet steel having a rim or flange portion B' bent transversely to the body portion of the plate, so that the free edge of the rim portion may abut against the door frame sealing surface E'. The body portion of the sealing member, thus forms a so-called through plate, which extends across the door opening and overlaps the sealing surface E' in the closed position of the door. The body portion of the sealing member is interposed between the plug section C and the outer door section A, and projects laterally beyond the margin or side edge of each of the door sections C and A. Such lateral extension of the flexible sealing member of the door is essential, in general, in any form of a self-sealing coke oven door. For the general purposes of the present invention, however, the use of a sealing member which is of the through plate type, or which as a transverse rim portion integrally connected to the body portion of the sealing member, is not essential.

In the particular door construction illustrated, the plug section of the door comprises a bottom member in the form of a metal casting including a horizontal shelf-like body portion adapted to overlap the door sill E^2, and a vertical flange portion C^2, depending from the outer edge of the shelf portion. The lower edge of the flange C^2 extends into engagement with the upper side of the horizontal bottom portion of the sealing rim B, and the outer side of flange C^2 is clamped against the adjacent surface of the through plate or body portion of the sealing member, by clamping screws F. As shown the plug section bottom casting C' includes a portion C^3, above the shelf portion, extending about a tubular passage in register with an opening B^2 in the sealing member B. The opening B^2 is in register with a tubular section B^3 welded to the outer side of the sealing member B, and normally closed by screw plug B^4. The opening B^2 and associated parts are provided for the insertion into the coking chamber, of a pipe supplying fluid fuel used in initially heating the oven up to operating temperature. In regular operation, the plug B^4 seals the opening B^2, and the passage surrounded by the casting portion C^3 is filled with refractory brick or plug parts.

The plug section of the door includes a vertical metallic post C^4 advantageously welded or bolted to the bottom casting C'. The post C^4 is surrounded except at its outer edge by ceramic material, which is interlocked with the post and which may be a monolithic mass, or a column of fire bricks or blocks. At its upper end, the post C^4 is connected to the sealing member B, by means of a plate G, formed with an aperture through which the reduced upper portion of the post C^4 extends, and detachably connected to the plate B, by means of bolt parts G welded to the plate G, and extending through the member B as shown in Fig. 2.

The upper end of the post C^4 is covered by a detachable refractory block forming the top section of the plug section of the door. The latter extends nearly to top of the oven chamber in a coke side door, but in the pusher side door provided with a levelling bar door, which is shown in the drawings, the top of the cap member C^5, must not extend above the level of the lower edge of the levelling bar door opening.

In the door construction illustrated, the entire weight of the plug and sealing sections of the door, and of the levelling bar door part carried by the sealing section, is supported by a narrow inwardly extending projection A^4 from the bottom part A^2 of the rigid outer section of the door. In the closed position of the door the projection A^4 extends between the side walls of a recess or guide way E^3 formed in the bottom portion of the door frame member E, and open at its outer side. The weight of the plug section of the door is transmitted to the projection A^4 through the portion of the sealing member flange B interposed between the upper side of the projection A^4 and the lower edge of the flange C^2 of the plug section bottom casting.

The top member A' of the outer frame section of the door is formed with a hook portion or projection A^5, extending inwardly over the top portion of the sealing member B. In the normal closed condition of the door, the projection A^5 extends into a recess E^4, formed in the top or lintel portion of the door frame member E, and having a smooth horizontal bottom wall surface E^5 on which the corresponding horizontal underside of the hook A^5 bears as shown in Fig. 2. The entire weight of the door is thus transmitted to the horizontal wall surface E^5 of the door frame member through the hook part A^5 of the outer door section. Advantageously, the side walls E^6 of the recesses E^3 and E^4, have outer portions E^6 outwardly flared to guide the door into place in the door closing operation, and have inner portions between which the projections A^4 and A^5 are received without unnecessary clearance or freedom for lateral displacement. The door supporting provisions described in the preceding paragraphs, are not claimed herein, but are claimed in my divisional application Serial No. 253,765, filed January 31, 1939.

Each of the adjustable connections between the sealing member B and the outer door section A, in the form of construction shown in Figs. 1 to 6, comprises a member H connected at its inner end to the sealing member B, and having a horizontal bar-like body portion formed with a longitudinal slot H'. The slot receives inner and outer wedges I and J, which have their remote edges in engagement with the end walls of the slot H, while their adjacent edges bear against the inner and outer edges respectively of projection K and K' from the adjacent portion of the rigid outer door section A. As shown the parts K and K' are steel bar sections welded to the adjacent portion of the door section A and are spaced apart to provide a space receiving the body portion of the member H, and are formed with notches K^2 which receive the wedges I and J, thus holding the latter and the part H against movement laterally toward or away from the adjacent portion of the door section A.

As shown in Fig. 6, the remote sides of the wedges I and J are vertical, as are the end walls of the slot H', while the bottom walls of the notches K^2 are inclined to the vertical, to correspond with the taper of the wedges. However, either edge of either wedge may be inclined to the vertical. The remote edges of both wedges are inclined, and the end walls of the slot H' in the member H, are correspondingly inclined, in Figs.

7, 8 and 9. In the forms shown, each member H has a yoke or clevis head H^2 at its inner end, connected by clevis pin H^3 to a piece of plate metal H^4. The latter is welded to the outer side of the sealing member B and is formed with an aperture to receive the corresponding clevis pin H^3. As shown in Figs. 5 and 8, the common central plane of the wedges I and J and clevis pin H^3 is advantageously coincident with, or close to the central plane of the adjacent portion of the sealing member flange or rim B. As will be apparent, each member H may be given a bodily adjustment towards the coke oven structure by raising the corresponding wedge I and lowering the corresponding wedge J; and by raising the wedge J and lowering the adjacent wedge I, the corresponding member H may be given an adjustment in the direction away from the oven chamber. In practice the wedges will ordinarily be given their vertical adjustments by hammer blows.

In lieu of welding the parts K and K' to the door section A, each pair of such parts may be integral ears of a bracket bolted to the door section A, or, as shown in Figs. 7, 8 and 9, in lieu of the parts K and K', the wedges I and J and the member H may cooperate with punched out integral tongue portions A^{10} of the outer section A of the door.

The described wedge adjusting connection is not only simpler and mechanically superior to the previously used threaded adjusting connections, but is somewhat cheaper to construct. The lower cost of construction, and other advantages of the wedge adjusting connection, are of especial practical importance because of the large number of adjusting connections required in a single installation. For example, a single coke oven battery may have 70 oven chambers or so, with two doors for each chamber, and with 20 or more adjusting connections for each door. In the practical door design illustrated in Figs. 1–6 there are nine wedge adjusting connections at each side of each door, and two such connections engaging each of the horizontal top and bottom portions of the sealing member. Notwithstanding the comparative ease with which the member H of each adjusting connection may be adjusted in the direction of its length, in the normal condition of the door each of the members H is rigidly secured to the rigid outer door section A, so that it is not necessary to provide any additional tie or anchor between the outer door section A, and the sealing or plug sections of the door. In this connection account should be taken of the fact, hereinafter mentioned, that the removal and replacement of the door does not subject the door to gravitational stress changes tending to move the door sections A, B and C relative to one another.

Except for the clamping of a small lower portion of the sealing member against the plug section casting part C^2, and between the latter and the projection A^4 from the outer door section A, the sealing member B is restrained only by its own stiffness against relative movements of its different marginal portions respectively connected to the different wedge adjusting devices. This makes it practically possible to obtain ample sealing member flexibility with a sealing member plate thickness and inherent strength desirably greater than is obtainable with earlier self-sealing door constructions, having similar sealing member flexibility.

As those skilled in the art will readily understand, the wedge adjusting devices disclosed are especially suitable for use under such operating conditions as customarily prevail in the production of metallurgical coke. Each coke oven door may weigh in the neighborhood of three tons. Its plug section refractory material is normally white hot. The aggregate contact pressure between the edge of the sealing rim B' of each door and the door frame sealing surface E' customarily amounts to thousands of pounds. The sealing member adjusting connections are customarily exposed to rain, snow, furnace dust and frequently to corrosive gases. The resultant corrosion, or oxidation, of the threaded adjusting connections heretofore employed, makes those connections difficult to adjust in many cases, and in some cases, results ultimately in undesirable looseness in the connections. No such difficulties are experienced in the operation of the wedge connections which I have devised. Corrosion cannot prevent the proper tightening up of the wedge connections, and cannot interfere appreciably, with the case or accuracy of the wedge adjusting operation.

In the construction shown in the drawings, the coke oven door is normally secured in place with the proper sealing pressure between the sealing rim B' and the sealing surface E' of the door frame, by upper and lower locking bars L, each having its ends in engagement with door retaining hooks E^{10} carried by the door frame member. Each locking bar L is bodily movable towards and away from the door, and the door sealing pressure is due to springs M, one associated with each locking bar and acting between the latter and the door in a direction tending to spread them apart. Each spring M acts on the corresponding locking bar through a rocking element N, having a pivot shaft N' supported by the rigid door section A. As shown, each locking bar L is a casting formed with a yoke portion L' through which the corresponding spring M extends. The portion L' is hinge connected to the corresponding rocking member N.

The latter, as shown, is a casting and in effect is a bell crank lever having an uprising arm comprising a central part N^2 and side parts N^3, and a horizontal arm extending outwardly in front of the shaft N'. The uprising portion N^2 of the lever N acts against the inner side of the yoke L' and the uprising portions N^3 act against the outer sides of pin like projections L^2 from the yoke L'. The hinge connection between each lever N and associated locking bar L, causes the locking bar to be moved bodily toward and away from the door, by clockwise and counter-clockwise movements, respectively, of the lever N. The pivot shaft N' for the upper lever N is journalled in a bracket NA, and the pivot shaft N' for the lower lever N is journalled in a bracket NB. The brackets NA and NB are each bolted or otherwise secured to the rigid outer door section A, and differ from one another only in respect to features of form by which they are adapted for engagement by a particular form of door machine and which do not need to be described herein.

Each spring M is compressed between upper and lower washers M' and M^2. The lower washer M' is seated on the horizontal arm portion of the corresponding lever N, and the upper washer M^2 is engaged by a nut threaded on a stem M^3 extending axially through the spring and having transversely extending projections M^4 at its lower end which engage the under sides of hooks N^4, carried by the corresponding bracket NA and NB.

The brackets NA and NB have parts extending over the locking bar projections L^2 in the assembled condition of the apparatus thereby preventing accidental separation of the locking bar and associated lever N.

One advantage of the locking bar arrangement shown, is that it permits the automatic unlocking of the door and the transfer of the door weight from the coke oven structure to a door handling machine, and the return of the door weight to the oven structure and the relocking of the door, in the door opening and closing operations, by up and down movements, respectively, of a vertically movable door lifting element of the door machine. To that end the said door machine element is adapted on its up movement to engage the under sides of the horizontal portions of the lever members N, and to give each of those levers a certain amount of clockwise movement, before the lifting member engages one or both of the brackets NA and NB and begins to lift the door in the door removing operation. The clockwise movement thus given the levers N should be sufficient not only to interrupt the normal tendency of the spring M to spread the locking bars and door apart, but to lift the locking bars out of engagement with the hooks E^{10}.

The weight of the door subjects the rigid outer door section A to tension stresses only, whether the door is suspended from the lintel of the door frame E by the projection A^5, only, whether the door is suspended from the lintel of the door frame E by the projection A^5, or from the lifting element of the door machine engaging both or more, usually the upper only, of the door parts NA and NB. The door is thus practically free from stress changes and resultant strains, as the weight of the door is transferred from the door frame to the door machine, and from the latter back to the door frame in the door removing and replacing operation.

While I regard the door locking means just described as the best form of means for the purpose now known to me, it forms no part of the present invention, which may be used with coke oven doors having other locking means. Various novel features of the locking means disclosed herein, are disclosed and claimed in one or another of my prior applications Serial No. 28,264, filed June 25, 1935; Serial No. 84,596, filed June 11, 1936; and Serial No. 102,943, filed September 28, 1936.

The particular coke oven door shown by way of example, in the drawings, is a "pusher side" door, and has a rectangular levelling bar opening B^5 formed in the sealing member B adjacent the top of the door. The portion of the sealing member B adjacent the margin of the opening B^5 is clamped between an outer levelling bar door frame member O and an inner rectangular cast iron frame member P. The opening B^5 is normally closed by a chuck door Q shown as supported by a lever arm R pivotally connected to one side of the door frame. The door Q may well be, and as shown, is of the type disclosed and claimed in my copending application, Serial No. 147,879, filed concurrently herewith, said door being adapted for automatic actuation between a fully closed and locked position, and a wide open position by means associated with the pusher machine carried mechanism for actuating the levelling bar adapted for operation through the opening B^5. It is unnecessary to make further reference herein to features associated with the chuck door Q for the automatic actuation of the latter, particularly as the invention claimed herein is adapted for use both in coke oven doors which have no levelling bar openings, and in doors having such openings, without regard to the character of the chuck doors associated therewith.

It is a matter of some significance, however, that the mechanism for removing and replacing the pusher side coke oven doors, is customarily mounted on the pusher machine employed to expel the finished coke charges from the different coking chambers of the battery with which the pusher machine is associated.

As is well known to those skilled in the art, the pusher machine customarily employed in connection with present day coke oven batteries is big and heavy, its weight being ordinarily in the neighborhood of 90 tons. With the door handling machinery for the pusher side oven doors mounted on the pusher machine for the battery, it is necessary, notwithstanding its size and bulk to "spot" the pusher machine, to bring its door handling machine into suitable register with each coke oven chamber, preparatory to each door handling operation. Really accurate registration for every such operation, is not practically obtainable, particularly because of the very small time available in some cases, for the operation, and for the manipulation of the big, heavy pusher machine. The operating conditions just referred to, enhance the merit of the door positioning provisions formed by the door projections A^4 and A^5 and the tapered door frame recesses receiving those projections in the closed position of the door. With those provisions a considerable variation in the position of the door machine relative to the oven chamber axis, may occur without preventing the replacement of the door.

While in accordance with the provisions of the statutes, I have illustrated and described the best form 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 door comprising in combination a flexible sealing plate member adapted to extend transversely into overlapping relation with a sealing surface at the margin of the doorway closed by the door, a plug section at the inner side of said sealing member and adapted to extend into said doorway, a rigid outer section at the outer side of said sealing member, means connecting said plug section and member to said outer section and through which the latter is adapted to support the plug section and member in door removing and replacing operations, door locking means adapted to releasably hold said outer section against movement away from surface and adjustable connections between said outer section and flexible member through which the outer section is adapted to press the flexible member against said sealing surface, said connections being distributed along the marginal portion of the sealing member and each connection comprising two relatively movable parts re-

spectively engaging said outer section and said sealing member and a wedge acting between said parts and adjustable to vary their relative positions.

2. A self-sealing door comprising in combination, a flexible sealing member adapted to extend into overlapping relation with a sealing surface at the margin of the doorway closed by the door, a rigid outer door section and a plurality of adjusting connections between said outer section and member, distributed along the marginal portion of the latter and each comprising a part attached to said section, a second part engaging said member, and a wedge cooperating with said parts to give them relative movement in one direction, and a second wedge cooperating with said parts to give them relative movement in the opposite direction.

3. A self-sealing door comprising in combination, a flexible sealing member adapted to extend into overlapping relation with a sealing surface at the margin of the doorway closed by the door, a rigid outer door section and a plurality of adjusting connections between said outer section and member, distributed along the marginal portion of the latter, and each comprising a part attached to said section and a part engaging said member and alongside the first mentioned part, one of said parts being formed with an elongated slot, a wedge extending through said slot and acting between one end wall thereof and one side of the other part, and a second wedge extending through said slot and acting between the second end wall of the latter and the second side of said other slot.

4. A self-sealing door comprising in combination, a flexible sealing member adapted to extend into overlapping relation with the sealing surface at the margin of the doorway closed by the door, a rigid outer door section, and a plurality of adjusting connections between said outer section and member distributed along the marginal portion of the latter and each comprising a part attached to said section, a second part engaging said member, one of said parts comprising spaced apart portions between which the other part is received and one of said parts being formed with a longitudinal slot and a wedge extending through said slot, and acting between the end wall thereof and the adjacent side of the other.

5. A self-sealing door comprising in combination, with a flexible sealing section adapted to extend into overlapping relation with a sealing surface at the margin of the doorway closed by the door, a rigid outer door section, and a plurality of adjusting connections between said sections, distributed along the marginal portion of the sealing section and each comprising a part rigidly attached to one of said sections, a second part pivotally attached to the other of said sections to turn about a vertical axis, one of said parts being formed with a vertical slot extending transversely to the plane of the doorway, and a wedge extending through said slot and acting between one end wall thereof and one side of the other part, the latter being notched at said side to receive said wedge, whereby the latter prevents the separation of said parts by turning movements of said second part about said axis.

6. A plug-type self-sealing door comprising in combination a flexible sealing member adapted to extend into overlapping relation with a sealing surface as the margin of the doorway closed by the door, a plug section secured to said sealing member, a rigid outer door section having an inwardly extending projection at its lower end engaged by said sealing member and supporting the weight of the latter and of said plug section, and a plurality of adjusting connections between said outer section and member, distributed along the marginal portion of the latter, and each comprising a part engaging said section, a second part attached to said member, and a wedge cooperating with said parts to give them relative movement in one direction, and a second wedge cooperating with said parts to give them relative movement in the opposite direction.

7. In a plug type self-sealing door, the combination with plug and sealing member door sections, of a rigid outer door section comprising a beam-like body portion of rolled steel of channel bar cross section, with its two flanges respectively adjacent, and parallel to the opposite side edges of the door, and cast steel end portions welded to the ends of said body portion, and adapted to engage a door frame in which the plug section of the door extends.

8. In a plug type self-sealing door, the combination with plug and sealing member door sections, of a rigid outer door section comprising a beam-like body portion of rolled steel of channel bar cross section with its two flanges respectively adjacent, and parallel to the opposite side edges of the door, and cast steel end portions welded to the ends of said body portion, and adjustable connections between said outer and sealing member sections some of which are at the sides of the door and include parts secured to the flanges of said beam-like body portion, others of which are alongside and include parts connected to said steel castings at the top and bottom of the door.

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