April 2, 1940. J. S. POTTER 2,195,840

COKE OVEN DOOR

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Fig. 2

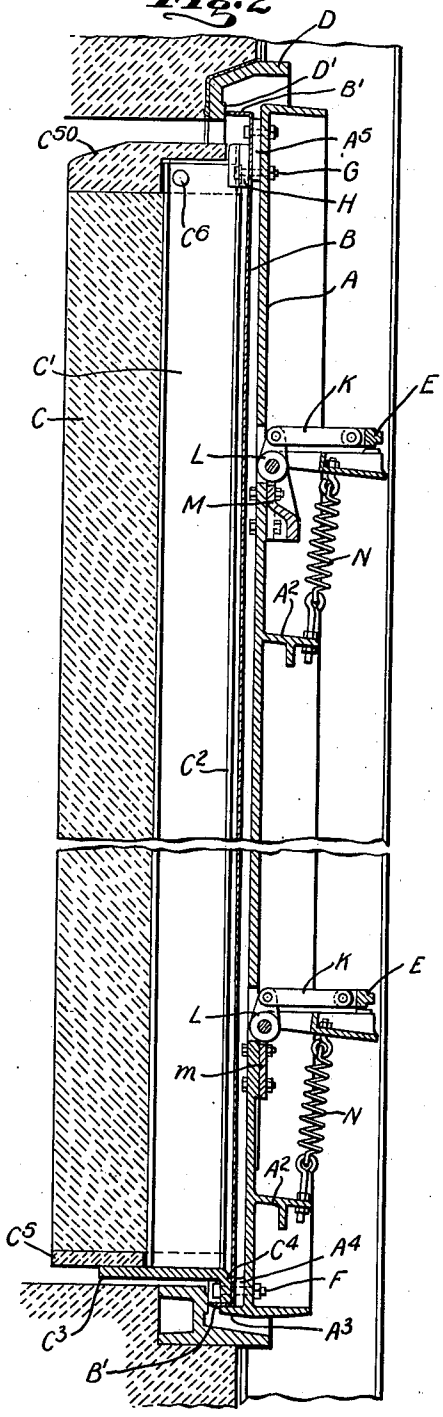
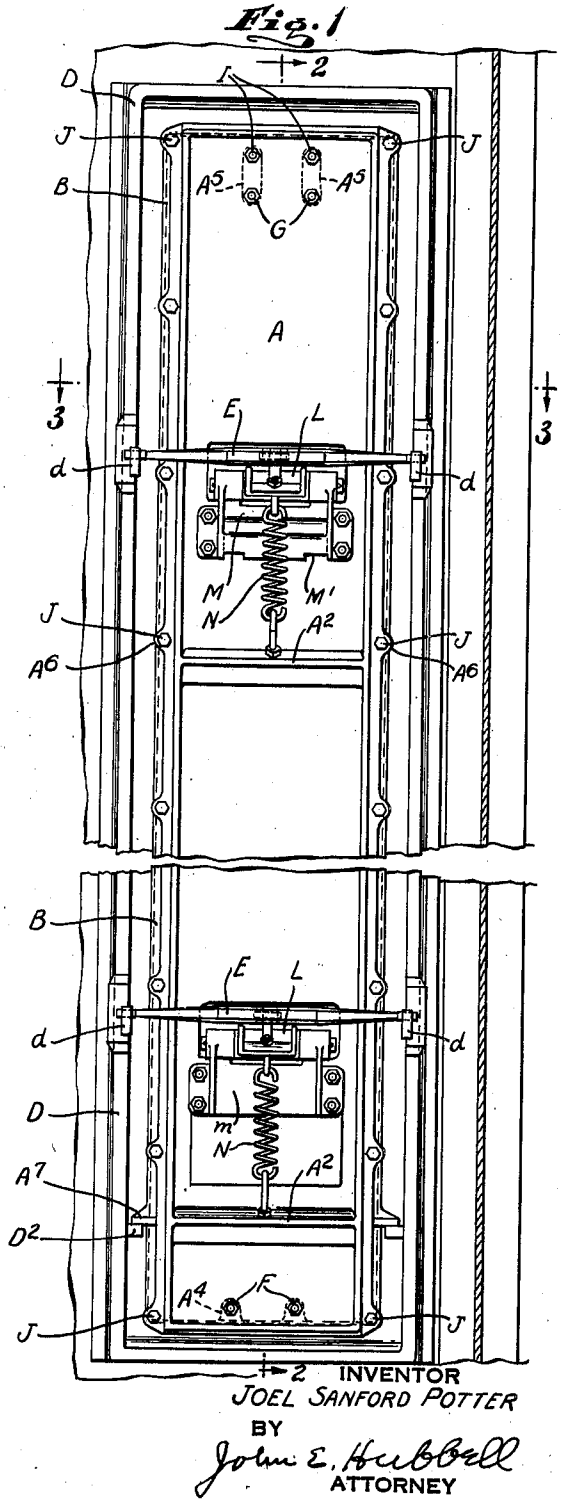


Fig. 1



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Fig. 3

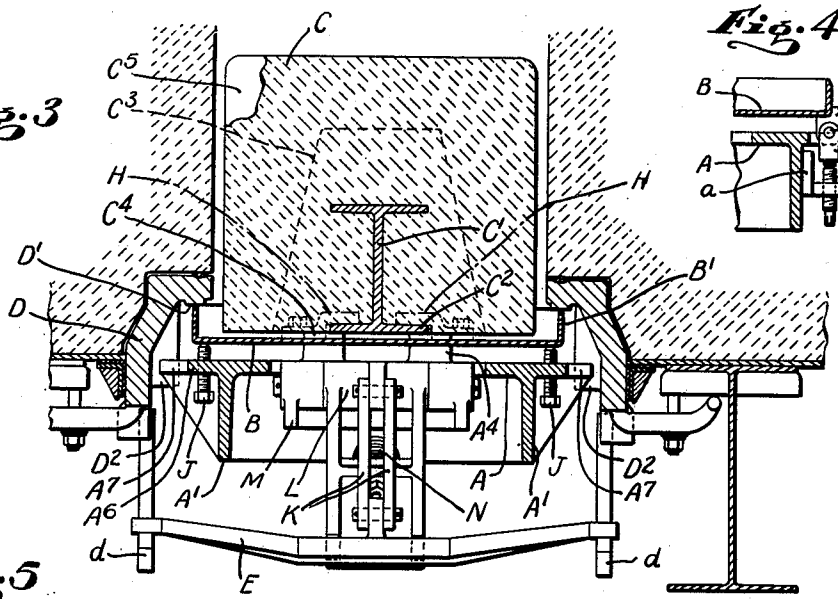


Fig. 4

Fig. 5

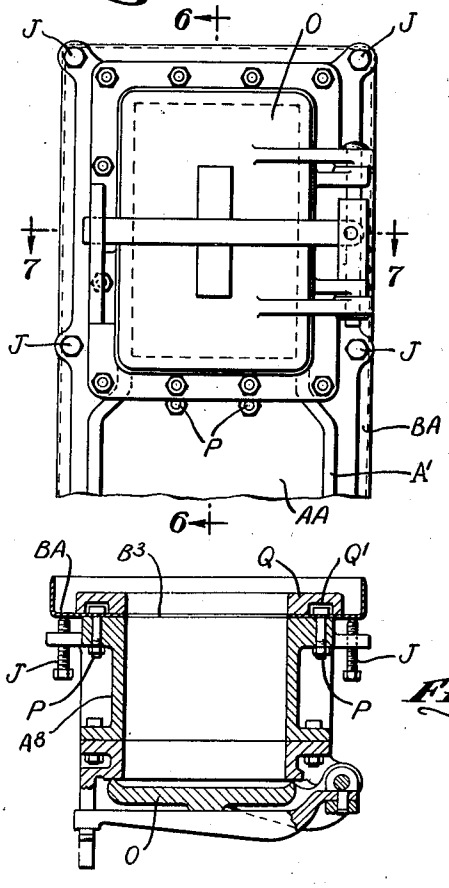


Fig. 6

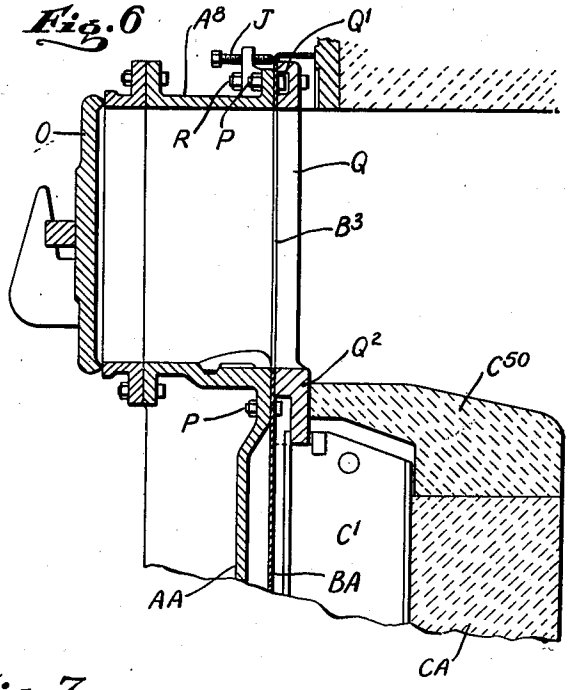


Fig. 7

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COKE OVEN DOOR

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Application July 2, 1936, Serial No. 88,676

3 Claims. (Cl. 202—248)

The general object of the present invention is to provide an improved self-sealing plug type door adapted for use as an end closure for a horizontal elongated coking chamber of the kind in general use for the production of metallurgical coke. The invention is more specifically concerned with the improvement of a coke oven door of the general type specified, and of the kind including a sealing section comprising a plate-like body, which is interposed between an inner plug section and a rigid outer metallic section of the door, and extends across a doorway closed by the door, and is provided at its margin with a flange or rim for sealing engagement with a frame member surrounding the doorway.

Specific objects of the invention are to provide a door of the type and kind specified, in which the three sections of the door are rigidly connected, by simple and easily detachable connecting means, at the top and bottom of the door, so that the heavy plug section of the door is suitably anchored at top and bottom to the rigid outer section of the door, while for the major portion of the length of the door, the body plate portion of the sealing section is free for movement toward and away from each of the other sections, so that the sealing edge of the sealing section may be readily shaped, as required, by adjustable connections customarily employed in doors of the general type, between the rigid outer and sealing sections of the door. The relatively great sealing section flexibility inherent in the construction, permits the sealing member to be made of sheet metal of greater thickness than is possible with the self-sealing doors of the kind heretofore most generally used, in which the body portion of the sealing section is clamped to, and projects away from the marginal portion of a rigid outer metallic section of the door.

Another specific object of the invention is to provide an improved plug section, forming a simple and effective mechanical unit, and one specially adapted for detachable connection with the other sections of the door in the manner above described.

Another specific object of the invention is to provide means whereby the coke oven door, when in its closed position, has its weight supported by the door frame through door and door frame engaging surfaces above the door sill level, so that there may be some clearance between the bottom of the door and the door sill portion of the door frame, thereby avoiding the interference with the proper seating of the door by coke or other material resting on said door sill portion.

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 preferred embodiments of the invention.

Fig. 1 is a side elevation of a portion of a coke oven battery including a door and the door frame in which the door is received;

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

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

Fig. 4 is a partial horizontal section, taken similarly to Fig. 3, illustrating a special form of adjusting connection;

Fig. 5 is a partial elevation taken similarly to Fig. 1, illustrating a second door form;

Fig. 6 is a vertical section on the line 6—6 of Fig. 5; and

Fig. 7 is a horizontal section on the line 7—7 of Fig. 5.

The coke oven door shown in Figs. 1, 2, and 3, comprises three main sections, namely, a rigid outer metallic section A, an intermediate sealing section B, and an inner plug section C. The latter, in the closed position of the door, extends into and forms a stopper or plug for the corresponding end of the coking chamber. Ordinarily, and as shown, the mouth of the coking chamber is lined with a rigid one piece metallic door frame D normally engaged by the sealing section B, and through which the plug section of the door projects as seen in Figs. 2 and 3. As shown, the door carries locking bars E which in the closed position of the door engages hooks *d* carried by, and projecting outwardly from the door frame.

The rigid outer section A of the door, as shown, is formed by a metal casting comprising a plate-like body or web portion with an outwardly extending marginal flange or rim portion A'. The web portion, as shown, is stiffened by integral transverse rib portions A^2.

The sealing section B of the door, as shown, comprises a flat body of sheet metal with a transverse marginal sealing rim or flange B'. The body portion of the section B extends through the space between the inner side of the outer door section A and the outer side of the inner door section C, and the sealing flange portion B'

extending inwardly, and has a bevelled sealing edge which, in the closed position of the door, engages a transverse sealing surface D' formed on the door frame member D.

The plug section C of the door, as shown, comprises a column-like mass of refractory material reinforced by a metal post C' within, and extending longitudinally of the refractory mass. The latter is shown as an I-beam, with one of its parallel members C^2 flush with the outer side of the plug section. The refractory material may consist of bricks, which may or may not be specially shaped to interlock with the post, but advantageously, and as shown, the refractory material is a monolithic mass which may be molded about the post, and does not need to be subjected to any firing action except that to which it is subjected when in place in a heated oven chamber. In such case, the post C' may well be heavily painted or coated with pitch, or the like, before the refractory material is molded about the post, so that the refractory material may expand longitudinally relative to the post under the temperatures of use.

A foot part C^3, shown as comprising a flat metal plate body portion extending transversely to the post, has its upper side engaged and welded to the lower end of the post C'. Preferably and as shown, the foot C^3 is not extended to the margin of the column of refractory material at the inner face and the side edges of the column, so as to minimize the heat absorption by the foot. While the weight of the refractory material is carried by the foot, in the preferred construction shown the refractory material rests directly upon a plate-like body C^5 of cast iron, the edges of which are flush with the edges of the column. The part C^5 formed with an opening receiving the post C', may be slid into place longitudinally along the post C'.

The plug section C is connected only at its top and bottom to the other sections of the door, and the connecting means provided are such as to permit the ready separation of each door section from the other. At the bottom of the door, the section connection means, comprise one or more clamping bolts F, two being shown, which extend through the web or body plate portion of the section A, through the body plate portion of the section B, and through a corresponding down turned ear or flange portion C^4 of the foot part C^3. As shown, the outer frame section is formed at its bottom with an inwardly extending flange A^3, which extends beneath the ear portion or portions C^4 of the foot part C^3, and is spaced from the latter by the corresponding portion of the rim flange B' of the sealing member. The frame section A is provided with integral reinforcing or pad portions A^4 through which the holes for the bolts F are formed, and which serve to space apart the body or web portions of the door sections A and B.

Similar reinforcing or pad portions A^5 of the section A web, are provided adjacent the top of the frame section A, where the top of the post C' is anchored to the body plate or web portion of the frame section A, by bolts G, each of which passes through said web portion, and through the corresponding reinforcing pad A^5, and through the body portion of the sealing section B, and through a clamping part H which overhangs the adjacent edge of part C^2 of the post, as indicated by dotted lines in Fig. 3. The clamping parts H do not grip the post part C^2 so as to interfere with vertical movement of the top of the post relative to the parts H occurring as a result of thermal expansion. Advantageously, and as shown, a removable cap piece C^{50} of refractory material forms the top of the plug section of the door and is recessed to receive the clamping parts H and the upper end of the post C', which extend above the main refractory material mass and is advantageously formed with a hole C^6 for engagement by a crane hook or the like for manipulating the plug section of the door when the cap piece C^{50} and bolts F and G are removed. Above the bolts G and clamping parts H, the web portion of the sealing section B is clamped against the upper ends of the pads A^5 by bolts I. Those bolts hold the sections A and B together in assembling or disassembling the door when the plug section is not secured to the other sections by the bolts F and G.

Except for its end portions, where such movement is prevented by the bolts F, G, and I, the web portion of the sealing section B is bodily movable transversely of the sections A and C in the space between those sections, as required to insure proper sealing engagement of the flange B' with the door frame sealing surface D', notwithstanding relative deformation of the door and door frame, resulting from the stresses, and particularly the thermal stresses of operation. To give the bevelled edge of the sealing flange B' the contour required to insure proper engagement with the surface B', adjustable clamping connections between the outer rigid section A and the marginal portion of the sealing section B, are provided. Those adjustable connections may be of any usual or suitable form. As shown in Figs. 1, 2, and 3, they comprise a multiplicity of horizontal bolts T threaded through bracket ear extensions A^6 from the rigid door section A, distributed about the margin of the door. Each bolt J bears against the sealing section B adjacent the margin of the latter. By relative adjustment of the different bolts J, the edge of the flange B', may be pressed snugly against the sealing surface D' at all points along the length of the latter, regardless of how that surface may be distorted from its initial plane condition.

In lieu of some or all of the bolts J, I may use bolts JA, shown in Fig. 4, which have inner and outer portions oppositely threaded. The inner threaded portion of each bolt JA is screwed into a threaded socket formed in a clevis member JB. The latter is connected, as by a pivot pin JB', to a corresponding reinforcement pad *b* welded to the section B. The oppositely threaded outer portion of each bolt JB might be screwed through an integral ear extension from the outer door section A, as in the construction first described, but as shown in Fig. 4, is threaded through a separate bracket part *a*, which may be adjustably and detachably clamped to the flange A' of the door section A. With the construction shown in Fig. 4, each pad portion *b* and immediately adjacent portion of the member B, may be pushed inwardly, or pulled outwardly by rotating the corresponding screw JA in one direction or the other.

The door shown in Figs. 1, 2, and 3, insofar as it has already been described, may be seated on the door sill portion of the door frame D in the closed position of the door, as has been customary heretofore. It is advantageous, however, to support the door from a portion of the door frame above its door sill level and to provide some clear-

ance between the door sill and the bottom of the door. By so supporting the door, I avoid practically all risk of interference with the proper seating and vertical disposition of the door, due to coke or ashes between the door and the surface or surfaces by which the closed door is supported. To this end, the door supporting means shown comprise opposed projecting lugs D^2 projecting laterally from the adjacent sides of the door frame member D, beneath and engaged by lugs A^7 extending laterally away from corresponding opposite side portions of the floor flange A'. Preferably, the lugs or projections D^2 and A^7 are adjacent the lower end of the door so as to be displaced downwardly, as well as outwardly from the center of gravity of the door, so that the top of the door tends to turn inwardly.

The locking bar arrangement forms no part of the present invention, and may be of any usual or suitable form. The particular arrangement shown is of the desirable form disclosed and claimed in my prior application Serial No. 84,596, filed June 11, 1936, in which each locking bar E is connected by links K to the vertical arm of a corresponding rocking element L journalled in a bracket member secured to the web portion of the rigid door section A. As shown, the bracket member M for the upper rocking element, is formed with a portion M' for engagement by the door lifting hook of a door machine, while the lower bracket *m* includes no such portion. Each rocking element L includes a horizontal arm connected by a spring N to the subjacent rib A^2. Each spring N thus acts in the closed condition of the door, to press the adjacent locking bar outwardly against the cooperating hooks *d* and to press the door sealing edge B' inwardly against the sealing surface B^2. The spring action tending to move the locking bar away from the door, may be relieved by an upwardly acting force on the horizontal arm of each element L, which may be exerted by the door machine in the door removal operation. Counter-clockwise turning movement given to the element L by the upwardly acting force will lift the associated locking bar above the corresponding hooks *d*.

The "pusher side" door shown in Figs. 5, 6, and 7, differs from the coke side door shown in Figs. 1, 2, and 3, in that it is formed with an opening adjacent its upper end for the passage of a levelling bar. That opening is normally closed by a door O mounted on an open ended box-like extension A^8 of the outer door section AA which differs, in this respect, from the section A of the construction first described. The portion of the levelling bar opening surrounded by the extension A^8, is in register with the portion of the opening formed by a hole B^3 in the web of the door sealing section BA. The portion of the sealing section web at the margin of the opening B^3, is clamped against the adjacent portion of the member AA to provide a gas tight joint, by suitably distributed clamping bolts P. The inner side of the portion of the sealing section BA at the margin of the opening B^3, is covered, and protected against overheating, by a rectangular cast iron frame member Q which is held in place by bolts R at its corners, one of which is shown in Fig. 6. The particular number and location of the various bolts P and Q is not essential. The member Q is formed with a channel Q' receiving the heads of the bolts P, and at its bottom, the member Q is provided with a portion Q^2 serving the plug section guiding and anchoring purpose of the parts H of the construction first described. The plug section CA of the pusher side door may be identical with the plug section C, except that the plug section CA terminates below the level bar opening and hence is relatively shorter than the plug section of the coke side door.

While the flexibility and freedom for transverse bodily movement of the upper portion of the sealing section BA is reduced by clamping the latter to the section AA at the margin of the levelling bar opening, for the major portion of the length of the door, the section BA has the same flexibility and freedom for transverse movement possessed by the section B. The most usual and most marked deformation for which a compensating adjustment of the sealing means of a self-sealing coke oven door is required, is the curvature or bending of the vertical sides of the door frame member about a horizontal axis. In respect to its flexibility and capacity for adjustment movement to compensate for such door frame curvature or bending, there is no significant difference between the sealing sections B and BA. With the arrangement shown in Figs. 5, 6, and 7, the bolts P serve the assembly and disassembly purpose of the bolts I of the construction first described.

In respect to the formation of the door in separable outer, sealing and plug sections, and in the formation of the plug section as a separate mechanical unit or entity, the door construction disclosed and claimed herein, incorporates and utilizes inventive features and principles disclosed and claimed in the patent of Louis Wilputte No. 2,131,829, granted October 4, 1938, on an application filed January 9, 1935, and in the application of Louis Wilputte, Serial No. 52,995, filed December 5, 1935. In particular, the sealing members B and BA may advantageously be formed from sheet metal, of a thickness of a quarter of an inch or so, with rim portions which are integral extensions of their web portions. In respect to the rigid connection of the three door sections at the bottom of the door, and their connection at the top of the door whereby each section is held against transverse movement relative to the others, and in respect to the form of those connections, and in respect to the manner in which the door is seated and supported by its door frame members, the doors illustrated and described herein, have practically important advantages over the doors illustrated and described in said prior applications.

The risk that the door in its closed position, will be held above the desired level by coke between the door and door supporting portion of the battery structure, may be practically eliminated with the lugs A^7 located above the center of gravity of the door, or replaced by a hook portion adapted to engage the upper side of the horizontal top portion of the door frame. The location of the door supporting lugs A^7 below the center of gravity of the door, however, insures the previously mentioned desirable tendency of the top of the door to turn inward, so as to effect proper sealing engagement of the upper portion of the door with the sealing surface D', and minimizes the risk that the weight of the door may subject the door frame to objectionable stress.

The avoidance of variation in the vertical disposition of the closed door relative to the door frame, practically insured by the described door supporting arrangement, coupled with the fact

that the upper and lower portions of the sealing edge of the flange B' are always at the same horizontal distance from the top and bottom portions of the rigid outer section of the door, facilitates the proper engagement of the door by the door handling machine by which the door is put into place and removed. This is particularly true when the door handling machine includes such means as are provided in my prior application Serial No. 84,596, for engaging the door frame at its top and bottom and thereby insuring a fixed displacement of the door engaging provisions of the machine from the plane including the upper and lower portions of the door frame sealing surface D'.

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. The combination with a vertically disposed coke oven door frame and a plug type, self-sealing, coke oven door adapted to be removably inserted in and removed from said door frame by substantially horizontal movements of the door, of means for supporting the door from said frame with clearance between the bottom portions of the door and door frame, comprising cooperating door frame and door parts located above the level of the bottom of the door frame, said parts having their engaging surfaces substantially horizontal, and means for releasably securing the door in the door frame.

2. The combination with a vertically disposed coke oven door frame and a plug type, self-sealing, coke oven door adapted to be removably received in said door frame, of means for supporting the door from said frame with clearance between the bottom portions of the door and door frame, comprising projections from the sides of the door frame and projections from the door adapted to rest on the first mentioned projections, said projections having their engaging surfaces horizontally disposed to permit substantially horizontal movement of the door into and out of the door frame, and means for releasably securing the door in the door frame.

3. The combination with a vertically disposed coke oven door frame and a plug type, self-sealing, coke oven door adapted to be removably received in said door frame, of means for supporting the door from said frame with clearance between the bottom portions of the door and door frame, comprising projections from the sides of the door frame and projections from the door adapted to rest on the first mentioned projections, said projections having their engaging surfaces below and at the outer side of the center of gravity of the door and horizontally disposed to permit substantially horizontal movement of the door into and out of the door frame, and means for releasably securing the door in the door frame.

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