Jan. 22, 1957 C. OTTO 2,778,784

SELF-SEALING COKE OVEN DOORS

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Fig. 1.

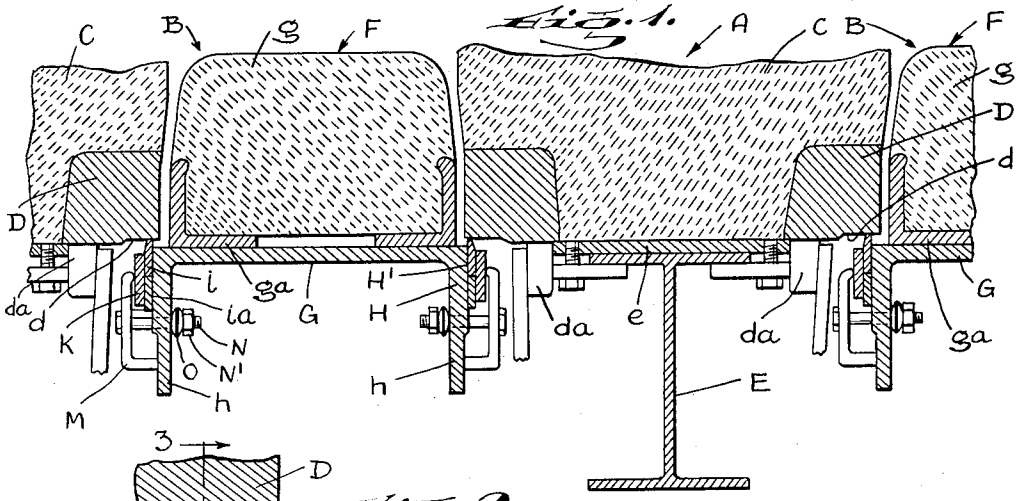


Fig. 2.

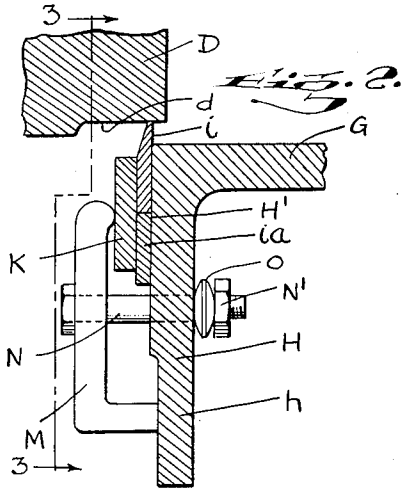


Fig. 3.

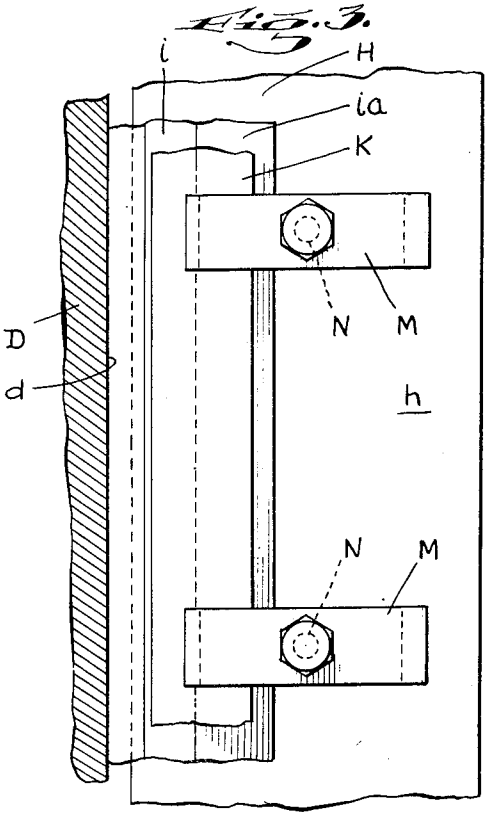
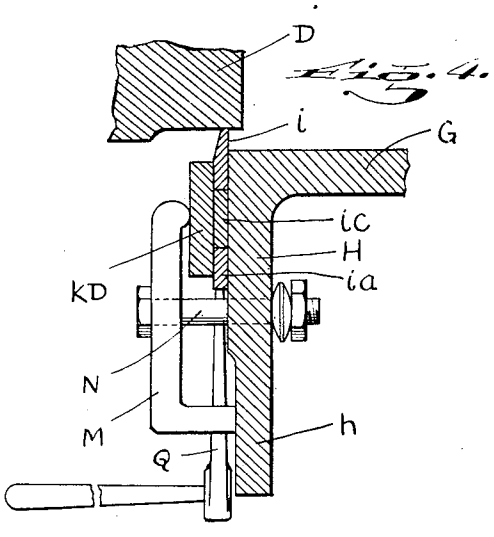


Fig. 4.



INVENTOR
CARL OTTO

BY
John C. Hubbell
ATTORNEY

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Fig. 5.

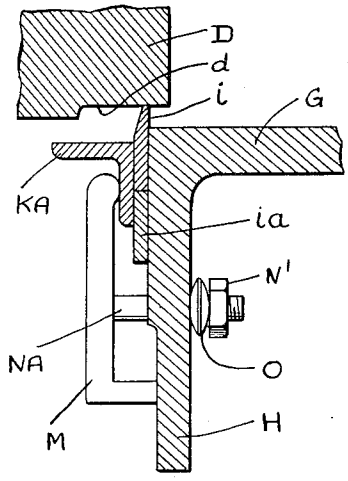


Fig. 9.

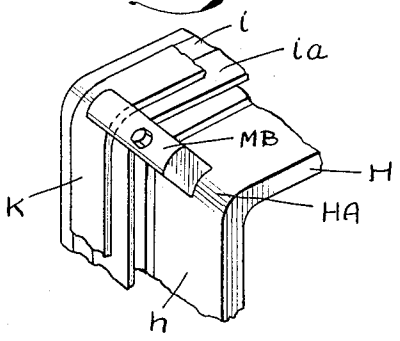


Fig. 6.

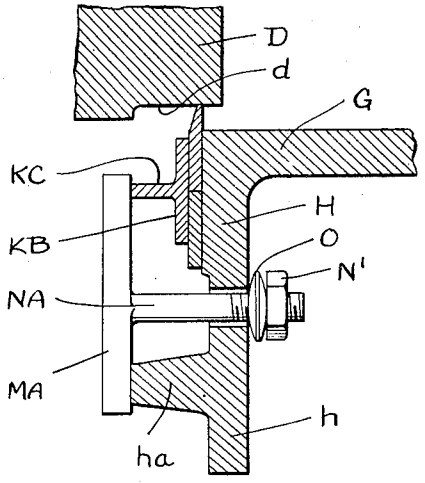


Fig. 8.

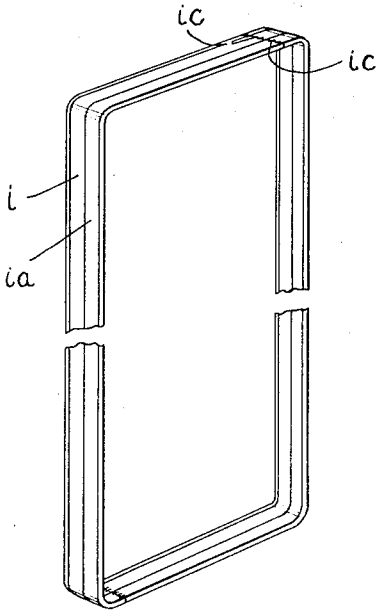
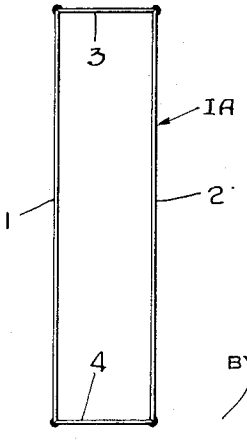


Fig. 7.



INVENTOR
CARL OTTO

BY John E. Hubbell
ATTORNEY

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SELF-SEALING COKE OVEN DOORS

Carl Otto, Manhasset, N. Y.

Application May 18, 1953, Serial No. 355,606

9 Claims. (Cl. 202—248)

The present invention relates to self-sealing coke oven doors of the type in which the door comprises a rim portion having a peripheral surface parallel to the axis of the oven chamber closed by the door, and in which said peripheral surface is surrounded by a sealing member in the form of a flexible metallic sealing strip or band transverse to and normally having its inner edge in sealing engagement with the outwardly facing sealing surface of an associated door frame.

More specifically, the present invention relates to doors of the above mentioned type in which the flexible metallic sealing strip surrounds an outer metallic portion of the corresponding coke oven door and has its flat inner surface pressed against a peripheral rim surface of the door, and is frictionally held in gastight contact with said door surface in the general manner disclosed in my prior application, Serial No. 323,807, filed December 3, 1952. The door embodying the present invention is like the door of said prior application in that the inner edge of the sealing strip bears against the outwardly facing sealing surface of the door frame surrounding the associated coking chamber; and in that the sealing edge is maintained in gastight engagement with the last mentioned surface by the application of hammer blows to the outer edge of the sealing member. The purpose and effect of the hammer blows are to reform any local section of the sealing member which does not operatively engage the door frame as required to insure such engagement, notwithstanding the warping or distortion of the door frame and the door occurring as a result of the operating conditions to which the door is subjected.

The primary object of the present invention is to provide improved means for maintaining the inner side of the sealing strip in gastight contact with the door surface surrounded and engaged by the sealing strip.

A still more specific object of the invention is to provide a sealing member divided into two or more sections displaced from one another in the general direction of the axis of the associated oven chamber when the door is in position to close one end of said chamber, the outer edge of each inner section being engaged by the inner edge of the adjacent outer section. Preferably, adjacent portions of each inner and outer section are overlapped by a strip bearing against the flat outer side of the two sections and arranged to seal the joint between the abutting edges of the sections. In some cases, the section surrounding, and in edge-to-edge engagement with, the inner section is surrounded and in edge-to-edge engagement with a third strip. By dividing the sealing strip surrounding the metallic peripheral surface of the door into a plurality of edge-to-edge sections, the flexibility of the individual sections, and of the sealing element collectively formed by those sections, is increased. However, when the joints between the abutting edges of adjacent sections are overlapped by the surrounding strip, it is possible to reduce the thickness of the sealing strip and particularly the thickness of the section of the strip which directly engages the door frame sealing surface. It is

also commercially feasible to make the thin inner section of stainless steel or other desirable material more expensive than the steel heretofore employed in making single section sealing strips.

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.

Of the drawings:

Fig. 1 is a horizontal section of a portion of a coke oven battery of conventional type;

Fig. 2 is an enlarged reproduction of a portion of the structure shown in Fig. 1;

Fig. 3 is a partial section taken on the line 3—3 of Fig. 2;

Figs. 4, 5 and 6 are sections taken similarly to Fig. 2 and each illustrating a different modification of the apparatus shown in Figs. 1, 2 and 3;

Fig. 7 is an elevation illustrating one sealing member structure; and

Fig. 8 is a perspective view illustrating a modified sealing member structure.

In Fig. 1, A designates a portion of a coke oven battery of conventional type including horizontal coking chambers B alternating with heating walls C at intervals along the length of the battery. End portions of two coking chambers B, and of two heating walls C at opposite sides of the chambers, are shown in Fig. 1. Each coking chamber mouth is surrounded by a metallic door frame D having an outwardly facing sealing surface *d*. The general structure and arrangement of the coking chambers B, heating walls C and door frame D, are conventional. Each door frame is received in recesses in the coke oven brickwork and is anchored in place by connections *da* to adjacent buckstays E. As shown, each conventional buckstay E at the end of each heating wall, directly engages a metallic flash plate *e* bearing against the outer surface of the brickwork and also overlapping and directly engaging outer edges of adjacent portions of the door frames at the opposite sides of the heating wall.

As shown, each coking chamber mouth is closed by a corresponding coke oven door F of conventional form comprising an outer portion G and an inner portion *g*. The inner or "plug" portion *g* of the door consists mainly of refractory non-metallic material, while the outer door portion G is a metallic structure to which the inner plug section of the door is attached by metallic brackets. The outer door body G comprises a main plate-like portion transverse to the door axis with a rigid peripheral rim or flange portion H which overlaps the sealing surface *d* in the normal closed position of the door. The flange or rim portion H has an outer stiffening rib extension *h* extending away from the plate-like body portion G of the door. The peripheral outer surface H' of the door rim portion H is parallel to the axis of the coking chamber B, and hence is transverse to the door frame sealing surface *d* when the door is in its normal closed position. The peripheral surface H' is surrounded by a metallic sealing element I in the form of a thin continuous band. The band I has a tapered inner edge or knife edge in sealing contact with the surface *d*, and has its flat inner side in snug contact with the rim of flange surface H'. Insofar as above described, the structure shown by Figs. 1 to 3 comprises nothing claimed as novel herein.

In the form of the present invention shown in Figs. 1, 2 and 3, the sealing member comprises an inner section *i* and an outer section *ia*. Normally the inner edge of

the section *i* is in engagement with the surface *d*, and the outer edge of the section *i* is in engagement with the inner edge of the section *ia*. The sections *i* and *ia* shown in Figs. 1, 2 and 3 are surrounded by a cover strip K which overlaps a substantial portion of each of the sections *i* and *ia*.

The sections *i* and *ia* are pressed against the surface H' by clamping elements M which may take various forms. In Figs. 1 to 3, each clamping element M extends horizontally away from the door frame surface *d* and has one end in engagement with the outer surface of the cover strip K and has its other end in engagement with a portion of the stiffening rib *h* which is displaced outwardly beyond the outer edge of the section *ia*. Each member M is clamped in place by a clamping bolt or extension N perpendicular to the adjacent portion of the stiffening rib and extending through an opening in the latter, and in threaded engagement with a clamping nut N' at the inner side of the stiffening rib. Advantageously and as shown, a spring washer O surrounds each clamping bolt N and is interposed between the corresponding rib *h* and nut N'.

As previously indicated, my improved sealing edge may be divided into more than two sections at different distances from the inner side of the door, and in Fig. 4 I have illustrated an arrangement in which a sealing section *ic* is interposed between an inner section *i* and an outer section *ia*. The three sections have their outer sides engaged by different portions of a common cover plate KD.

Other forms of the invention are illustrated by way of example in Figs. 5 and 6. The arrangement shown in Fig. 5 differs from the arrangement shown in Figs. 1, 2 and 3, in that its cover member KA has an angle bar cross section with one flange alongside the strip sections *i* and *ia*, and with its other flange extending between the door frame surface *d* and the adjacent ends of the clamping elements M. In the arrangement shown in Fig. 6, the cover plate KB is in the form of a T-bar with its central rib KC extending perpendicularly away from the adjacent portions of the sections *i* and *ia*. In Fig. 6 the clamping element MA is in the form of a straight bar with one end bearing against the edge of the rib KC and its other end bearing against a projection *ha* from the outer side of the corresponding outer edge portion *h* of the door body.

In Figs. 5 and 6 the bolts N are replaced by rods NA each having one end welded or otherwise integrally connected to the corresponding clamping elements M or MA, respectively.

My improved sealing elements may be formed in various ways. In the simple preferred form shown in Figs. 1–3, each of the band sections *i* and *ia* may comprise two vertical strips 1 and 2, and two horizontal strips 3 and 4 arranged as is the section *ia* shown in Fig. 7. In that figure, each horizontal strip 3 at the top of a door has its ends welded to the upper ends of the corresponding vertical strips 1 and 2. The second horizontal strip 4 of each section, located at the bottom of the door, has its ends welded to the lower ends of the corresponding vertical strips 1 and 2. In lieu of forming each section of four separate pieces welded together, as shown in Fig. 7, I may make each section of a one-piece metal strip bent into the form of a rectangle as shown in Fig. 8. In such case the corners HA of the rim portion H of the door may be rounded, each with a relatively small curvature radius. When each section is thus formed of a single bent strip of material with its ends welded together, the welded ends of the strip may be located at any convenient place. As shown in Fig. 8, the welded ends of each strip are adjacent one of the upper corners of the door.

When the sealing sections *i* and *ia* have rounded corners as shown in Fig. 8, special clamping elements MB may be employed at each corner of the door. One such corner clamping element MB, shown in Fig. 9, differs from elements of the form shown in Figs. 2 and 3 essentially only in that the surfaces of the element MB which engage the curved outer surfaces of the cover plate K and rib *h* are concave to fit snugly against said outer surfaces.

The sealing element disclosed herein, like the sealing element disclosed in my above mentioned prior application, Serial No. 323,807, is adapted and intended to have its edge immediately adjacent the door frame sealing surface *d*, reformed whenever necessary to maintain a sealing engagement between said inner edge and door frame surface *d* along the full length of said inner edge, by hammer blows impressed on the outer edge of the sealing element when and as required to maintain said contact. The necessity for reforming the sealing edge when and as required to maintain contact with the door frame sealing surface, has long been recognized.

The necessity for so reshaping the contour of the inner edge of the sealing element ordinarily arises from the warping or deformation of the door frame, and of the outer metallic portion of the door frame. It has long been common practice to reform the contour of the sealing edge by the action of screws mounted in internally threaded supports carried by the door and movable toward and away from the outer edge of the sealing element by the rotation of the screws in their threaded supports. It has recently been discovered, however, that improved results are obtainable by pressing the sealing element against the rim portion of the outer metallic door body with a suitable yielding force. That force must be great enough to prevent movement of the sealing element relative to the door when the latter is pressed against the door frame with the normal sealing pressure force and not great enough to prevent movement of the sealing element relative to the door under the impact of hammer blows against the outer edge of the sealing element. The normal sealing force may vary with the door dimensions and with operating conditions, but with a door having conventional dimensions the total pressure with which the sealing element engages the door frame is ordinarily of the order of 10 tons per door. As explained in my prior application, when the sealing element is so positioned relative to the stiffening flange of a coke oven door as to make it difficult or impossible to subject the outer edge of the sealing element to the direct impact of a hammer, effective use may be made of a drift or analogous tool. One such drift Q is shown herein in Fig. 4.

The division of the sealing element into edge-to-edge sections at different distances from the inner side of the door, has practically important advantages. With the sealing element thus divided into separate inner and outer sections *i* and *ia*, as illustrated and described herein, it is practically feasible to make the sealing members of thinner metal than has been required heretofore. The sealing strips heretofore in general use in self-sealing doors have had a thickness of about a quarter of an inch. With a sealing arrangement of the type shown in my prior application, Serial No. 323,807, the thickness of the sealing strip may be reduced to about one-sixteenth of an inch. With the sealing strips divided into edge-to-edge sections at different distances from the associated door frame in accordance with the present invention, the thickness of the sealing strips may be reduced to about two millimeters.

The reduction in the thickness of the sealing strip is practically important. For one thing, it directly increases the flexibility of the strip, and adds to the ease with which the inner strip may be reformed as and when necessary by hammer blows applied to the outer edge of the outermost section of the sealing element. The reduction in the thickness of the sealing element is practically important also, because it makes it economically feasible to form the inner section of the sealing strip of stainless steel or other special steel more effective for the purpose than ordinary carbon steel. At the current prices, stainless steel costs about eight times as much per pound as ordinary carbon steel of the type heretofore used in making self-sealing door strips. The extent to which the thick-

ness of the sections of my improved sealing element may be reduced, is greater when the inner section is formed of stainless steel than when formed of carbon steel.

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 coke oven door structure for closing the end of a coking chamber surrounded by a metallic door frame which has an outwardly facing sealing surface, said structure comprising an outer metalic door section having a peripheral rim surface extending transversely to said sealing surface in the normal closed position of the door, and a thin sealing member surrounding said peripheral rim and having its flat inner side bearing against said rim surface and having an inner edge normally in engagement with said sealing surface, said member being divided into a plurality of sections at different distances from said sealing surface with the outer edge of each inner section in engagement with the inner edge of an adjacent outer section, a cover plate engaging the outer flat side of each of said sections, and means connected to said metallic door part for pressing said cover plate against said rim surface with a force sufficient to hold said sections against movement relative to the door surface when the inner section engages the sealing surface with the normal sealing pressure, but insufficient to prevent movement of the inner edge of the sealing member toward said sealing surface when a hammer blow is impressed on the adjacent outer edge portion of the member.

2. A coke oven door structure for closing the end of a coking chamber surrounded by a metallic door frame having an outwardly facing sealing surface, comprising an outer metallic door section having a peripheral rim overlapping said sealing surface and having a surface extending transversely to said sealing surface in the normal closed position of the door, a thin sealing strip having a flat side bearing against said door surface and having an inner edge normally in engagement with said sealing surface and comprising a plurality of sections at different distances from said sealing surface with the outer edge of each inner section in engagement with the inner edge of each outer section, a cover plate engaging the outer flat side of each of said sections, and means connected to said metallic door part for pressing said cover plate against said door surface to maintain a contact pressure great enough to hold said sections against movement relative to the door surface when the inner section engages the sealing surface with the normal sealing pressure.

3. A coke oven door structure for closing the end of a coking chamber surrounded by a metallic door frame which has an outwardly facing sealing surface, said structure comprising an outer metallic door section having a peripheral rim overlapping said sealing surface and having a peripheral rim surface extending transversely to said sealing surface in the normal closed position of the door, and a thin sealing member surrounding said peripheral rim and having its flat inner side bearing against said rim surface and having an inner edge normally in engagement with said sealing surface, said member being divided into a plurality of sections at different distances from said sealing surface with the outer edge of each inner section in engagement with the inner edge of an adjacent outer section, a cover plate engaging the outer flat side of each of said sections, and means connected to said metallic door part for pressing said cover plate against said rim surface with a force sufficient to hold said sections against movement relative to the door surface when the

inner section engages the sealing surface with the normal sealing pressure, but insufficient to prevent movement of the inner edge of the inner-most of said sections toward said sealing surface when a hammer blow is impressed on the outer edge portion of the outermost of said sections.

4. In a coke oven battery having a peripheral wall and a plurality of spaced heating walls with coking chambers therebetween, said peripheral wall having a plurality of openings providing access to said coking chambers, and a door frame fixed to said peripheral wall and surrounding one of said wall openings and being provided with a sealing surface; a door for operably closing said one peripheral wall opening, comprising a door body, a sealing strip extending around the peripheral edge of said door body in surface-to-surface relationship therewith and disposed in planes substantially perpendicular to the plane of said sealing surface, said sealing strip being divided into two strip portions in substantialy abutting edge-to-edge relationship with the free edge of one of said strip portions being adapted to engage said sealing surface of said door frame in sealing relation therewith, the plane of abutment of said abutting edges of said sealing strip portions being at an angle to the planes in which said sealing strip is disposed, and means for clamping both said sealing strip portions against the peripheral edge of said door body.

5. In a coke oven battery having a peripheral wall and a plurality of spaced heating walls with coking chambers therebetween, said peripheral wall having a plurality of openings providing access to said coking chambers, and a door frame fixed to said peripheral wall and surrounding one of said wall openings and being provided with a sealing surface; a door for operably closing said one peripheral wall opening, comprising a door body, a sealing strip extending around the peripheral edge of said door body in surface-to-surface relationship therewith and disposed in planes substantially perpendicular to the plane of said sealing surface, said sealing strip being divided into two strip portions in substantially abutting edge-to-edge relationship with the free edge of one of said strip portions being adapted to engage said sealing surface of said door frame in sealing relation therewith and the free edge of the other of said sealing strip portions being exposed to receive hammer blows to adjust the position of both said sealing strip portions relative to said door body, the plane of abutment of said abutting edges of said sealing strip portions being at an angle to the planes in which said sealing strip is disposed, and means for clamping both said sealing strip portions against the peripheral edge of said door body.

6. An improvement as specified in claim 5, in which said strip portions are formed of different metals.

7. An improvement as specified in claim 5, in which said inner strip portion is formed of stainless steel and the other portion is formed of carbon steel.

8. In a coke oven battery having a peripheral wall and a plurality of spaced heating walls with coking chambers therebetween, said peripheral wall having a plurality of openings providing access to said coking chambers, and a door frame fixed to said peripheral wall and surrounding one of said wall openings and being provided with a sealing surface; a door for operably closing said one peripheral wall opening, comprising a door body, a sealing strip extending around the peripheral edge of said door body in surface-to-surface relationship therewith and disposed in planes substantially perpendicular to the plane of said sealing surface, said sealing strip being divided into two strip portions in substantially abutting edge-to edge relationship with the free edge of one of said strip portions being adapted to engage said sealing surface of said door frame in sealing relation therewith, the plane of abutment of said abutting edges of said sealing strip being at an angle to the planes in which said sealing strip is disposed, a cover in surface-to-surface relationship with portions of the surfaces of said sealing strip portions op-

posite the surfaces thereof in engagement with the periphery of said door body, and clamping means carried by said door body and engageable with the free surface of said cover for clamping said sealing strip portions against said periphery of said door body.

9. An improvement as specified in claim 8, in which said cover comprises a strip bearing against said strip portions and a flange portion transverse to said strip.

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