March 18, 1941. J. S. POTTER 2,235,686

CLOSURE FOR HORIZONTAL COKING CHAMBERS

Original Filed June 12, 1937 2 Sheets-Sheet 1

Fig. 1.

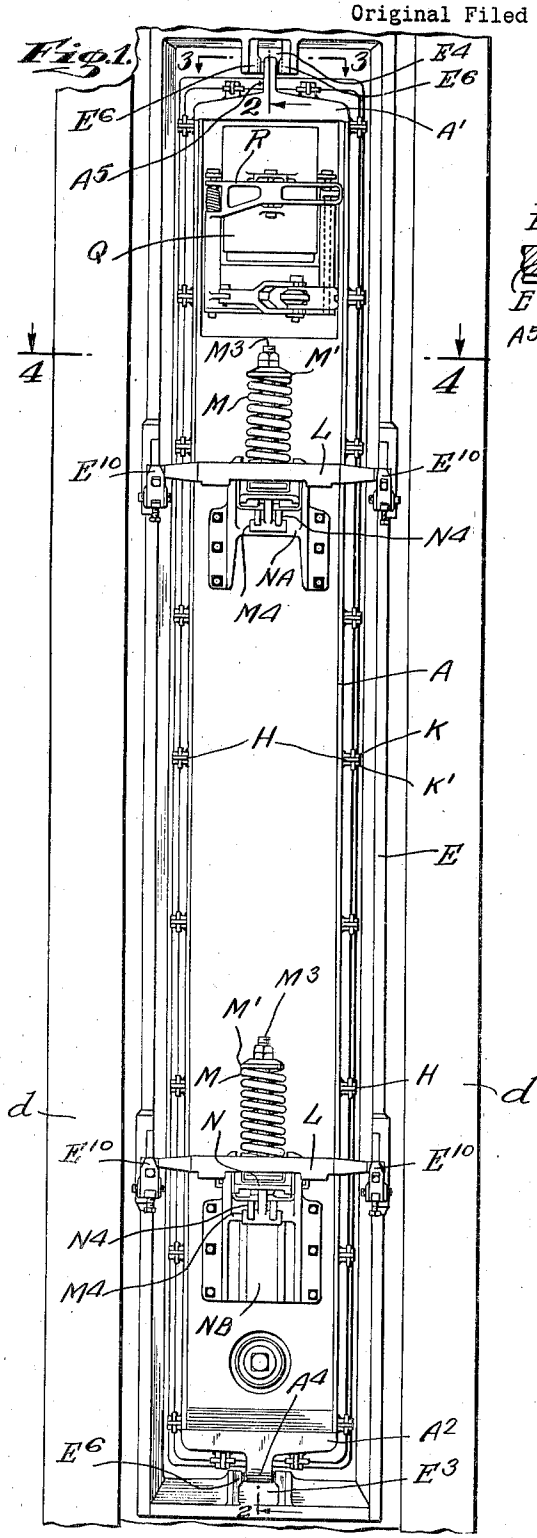


Fig. 3.

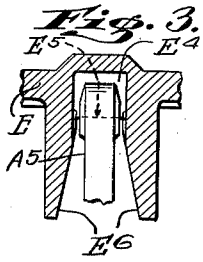
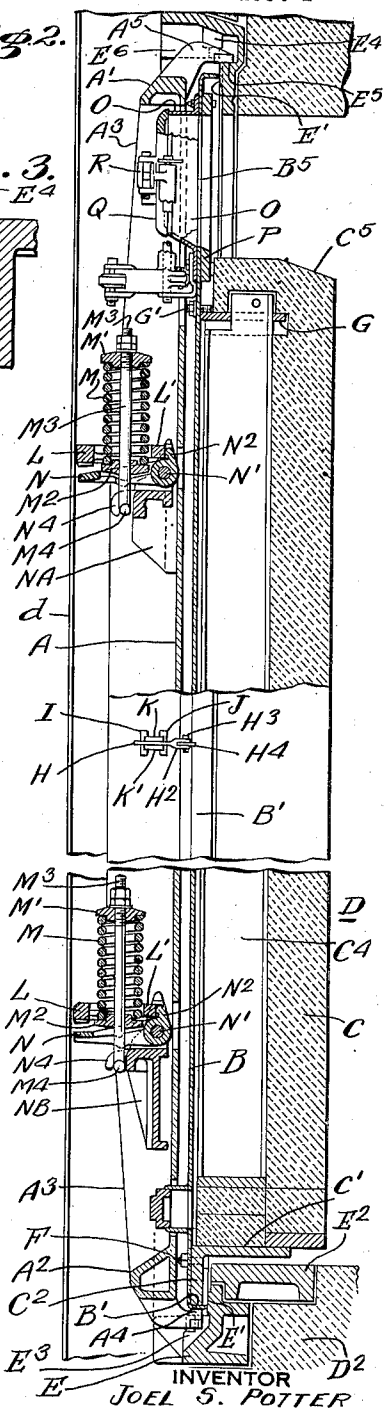


Fig. 2.



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Fig. 4.

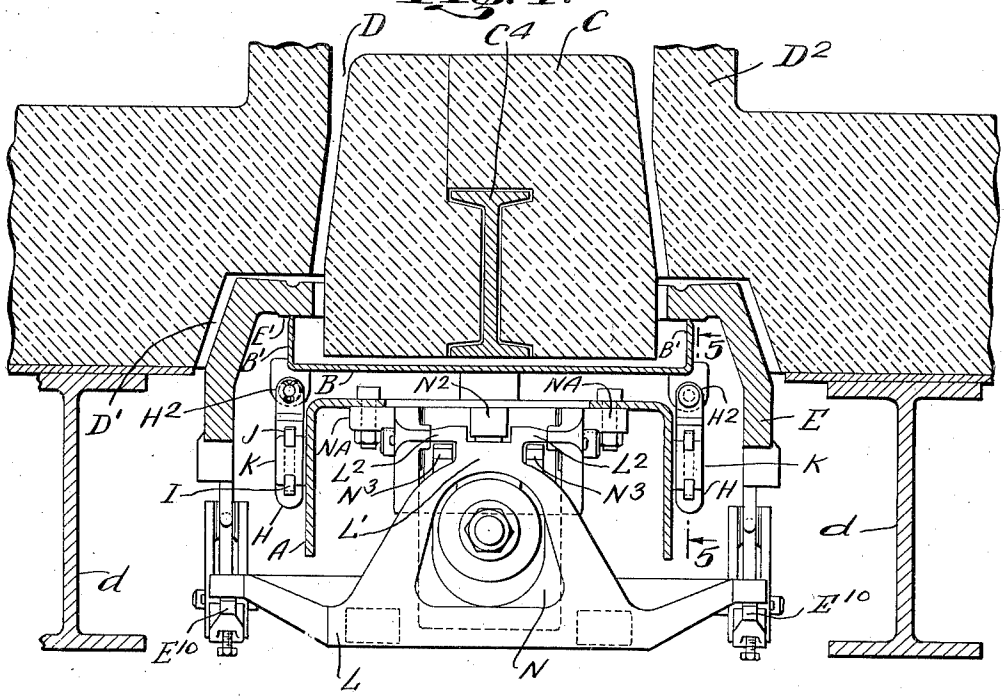
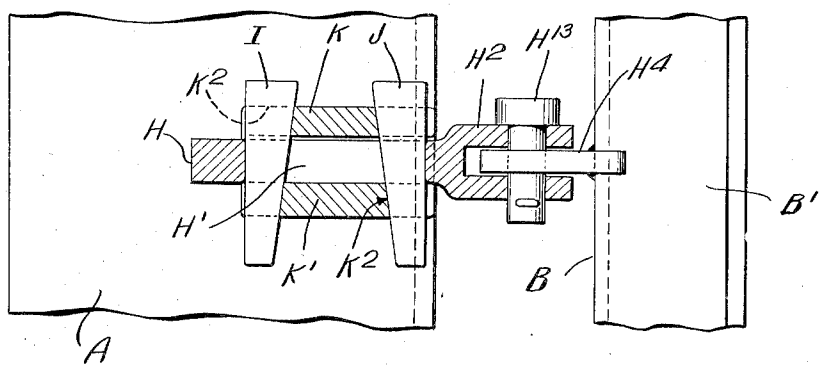


Fig. 5.



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UNITED STATES PATENT OFFICE

2,235,686

CLOSURE FOR HORIZONTAL COKING CHAMBERS

Joel Sanford Potter, West Nyack, N. Y., assignor, by mesne assignments, to Wilputte Coke Oven Corporation, New York, N. Y., a corporation of Maine

Original application June 12, 1937, Serial No. 147,878. Divided and this application January 31, 1939, Serial No. 253,765

4 Claims. (Cl. 202—243)

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 closed 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 and has a portion engaging a sealing surface on the door frame 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 the flexible part as required to bring its engaging portion contour into conformity with that of the door frame sealing surface. In some such 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 such 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 a barrier to gas flow into and out of the oven chamber.

Every plug type self-sealing coke oven door now in use in this country, of which I have knowledge, includes one or more locking bars mounted on the rigid outer section of the door, and nut and screw, or spring means adapted to create a force acting between each locking bar and the outer door section in the direction to spread them apart, whereby with the locking bar in engagement with the usual retaining hook carried by the door frame, the locking bar is restrained against movement outward away from the door frame sealing surface and the rigid door section is forced inward to thereby press the flexible sealing part against the sealing surface and establish the door sealing pressure. In the use of such doors, it is practically desirable that the movement of the rigid outer door section, occurring while the flexible sealing part is pressed against door frame sealing surface be in a horizontal direction, and include no substantial vertical component.

A specific object of the invention is to provide a coke oven door frame and door arrangement in which the weight of the door, when in its closed position, is suspended from the top or lintel portion of the door frame, through a rigid hook extension of the rigid outer section of the door, and in which the coacting hook extension and lintel engaging surfaces are shaped to permit the door sealing pressure to be established and released by substantially horizontal movements of the rigid outer section of the door; and a further and more specific object of the invention is to provide the door and door frame with special coacting guides, including said hook extension, at the top and bottom of the door adapted to suitably center the door, relative to the door frame, as the door is moved horizontally into its closed position. The present application is a division of the application for my prior Patent No. 2,157,569, granted May 9, 1939.

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; and

Fig. 5 is a partial section on the line 5—5 of Fig. 4.

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 consists largely of ceramic material, and 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 of 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 United States 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 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 has 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 C' 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.

A vertical metallic post C^4, advantageously welded or bolted to the bottom casting C', 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 the top of the oven chamber in a coke side door, but in the pusher side door provided with a levelling bar door Q as 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.

As shown, each of the adjustable connections between the sealing member B and the outer door section A, 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. The bottom walls of the notches K^2 are inclined to the vertical, to correspond with the taper of the wedges. As 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. Advantageously, and as shown in Fig. 4, the common central plane of the wedges I and J and clevis pin H^3 is 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 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 machne, 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 a lintel of the door frame E by the projection A^5, only, 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.

As previously indicated, the invention claimed herein is not restricted to use in and in connection with doors having resilient means acting between the rigid outer section of the door and the door locking bars, or in which the adjusting connections between the outer section of the door and the sealing member are formed by wedges, but is adapted for use in doors including the more usual nut and screw connections between the rigid outer section and the flexible sealing member of the door.

As will be apparent, the provisions through which the weight of the door is normally suspended from the door frame lintel, permit the door sealing pressure to be established and released by movements of the rigid outer door section relative to the door frame which include no vertical components. In consequence, there need be no vertical movement of the sealing rim B', while it is pressed against the sealing surface E' by the means establishing the door sealing pressure.

For a full appreciation of the advantages of the means disclosed and claimed herein for normally suspending the door from the top portion of the door frame, and for guiding and centering the door as the latter is being moved horizontally into its fully closed position, account should be taken of the door weight and its temperature and other operating conditions. Each coke oven door of the type illustrated may weigh in the neighborhood of 3 tons, and its plug section refractory material is normally white hot. The aggregate contact or sealing pressure between the edge of the sealing rim B' of each door and the door frame sealing surface customarily amounts to thousands of pounds. The external parts of the door are customarily exposed to rain, snow, furnace dust and frequently to corrosive gases. The character and disposition of the little shoulder E^5 of the surface of the suspension hook A^5 engaging that shoulder are obviously such as to minimize difficulties in establishing the desired door position in each door closing operation. The fact that in each door closing operation, some horizontal movement of the rigid outer section of the door is required to establish the sealing pressure, not only keeps the engaging surfaces of the hook A^5 and door frame lintel clean, but also tends to prevent ashes or coke breeze on

the door sill member E^2 from interfering with the proper closed position of the door.

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 June 12, 1937, 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, and, in the latter case, without regard to the character of the chuck doors associated with such openings.

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 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 end closure for horizontal coking chamber comprising a door frame formed with a recess in its top or lintel portion and with a substantially horizontal bottom wall for said recess, of a self-sealing plug type door comprising a plug section and a rigid outer section having an inwardly extending hook portion at its top adapted to enter said recess and engage and be supported by said bottom wall as said door is being moved horizontally into its closed position in which said plug section extends into said door frame, said bottom wall being constructed to receive said hook portion on solely horizontal approach of the latter.

2. A self-sealing end closure for horizontal coking chamber comprising a door frame formed with a recess in its top or lintel portion, said recess having a substantially horizontal bottom wall, of a self-sealing plug type door comprising a plug section and a rigid outer section having an inwardly extending hook portion at its top adapted to enter said recess and having a substantially horizontal under surface adapted to engage and be supported by said bottom wall when said door is in its closed position in which said plug section extends into said door frame, said recess having side walls above said bottom wall and extending outwardly beyond the outer edge of said bottom wall, and adapted to guide said hook portion for horizontal movement of the door into its closed position, said bottom wall being constructed to receive said hook portion on solely horizontal approach of the latter.

3. A self-sealing end closure for a horizontal coking chamber comprising a door frame formed with a vertically extending sealing surface and with a recess having a substantially horizontal bottom wall in the top or lintel portion of the door frame and with a recess in the portion of the door frame beneath the doorway, of a self-sealing plug type door comprising a plug section adapted to extend into said door frame and a rigid outer section having inwardly extending hook portions at top and bottom respectively adapted for horizontal movement into the first and second mentioned recesses into a position in which the hook portion at the top of the door engages and rests upon said bottom wall, said door also comprising flexible sealing means adapted to be forced into sealing engagement with said surface by horizontal movement of said rigid section, said bottom wall being constructed to receive said hook portion on solely horizontal approach of the latter.

4. A self-sealing end closure for horizontal coking chamber comprising a door frame formed with a recess, in the top or lintel portion of the door frame and with a substantially horizontal bottom wall for said recess of a self-sealing door comprising a rigid outer section having an inwardly extending hook portion at its top adapted to enter said recess and having a substantially horizontal under side surface portion adapted to engage and rest on said bottom wall, said bottom wall being constructed to receive said hook portion on solely horizontal approach of the latter.

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