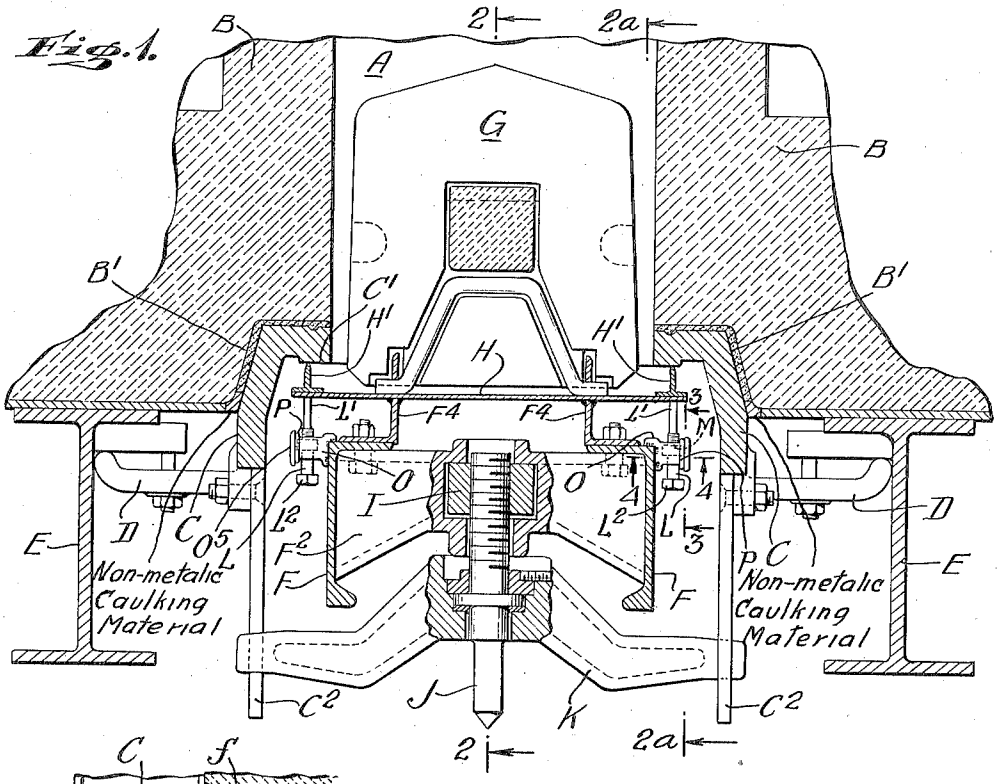
April 15, 1941. L. WILPUTTE 2,238,239

SELF-SEALING DOOR

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Fig. 1.



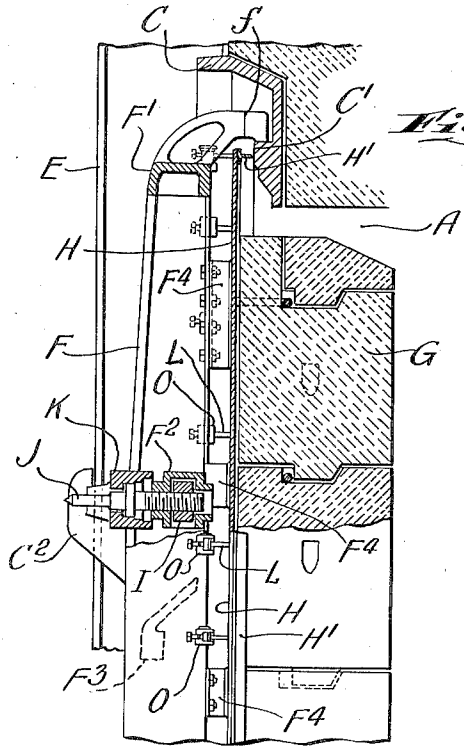
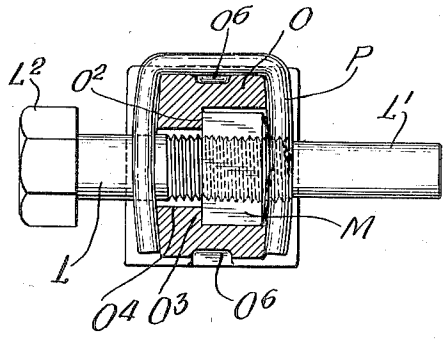


Fig. 2.

Fig. 3.



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Fig. 4.

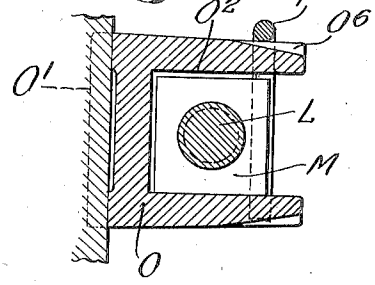


Fig. 7.

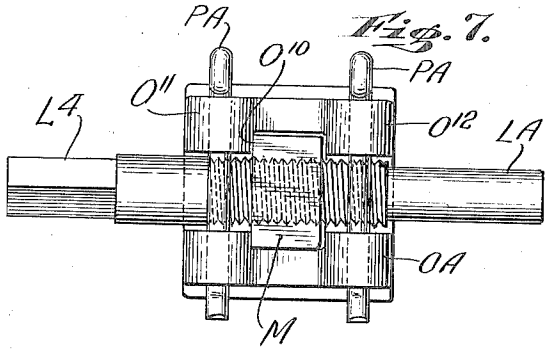


Fig. 6.

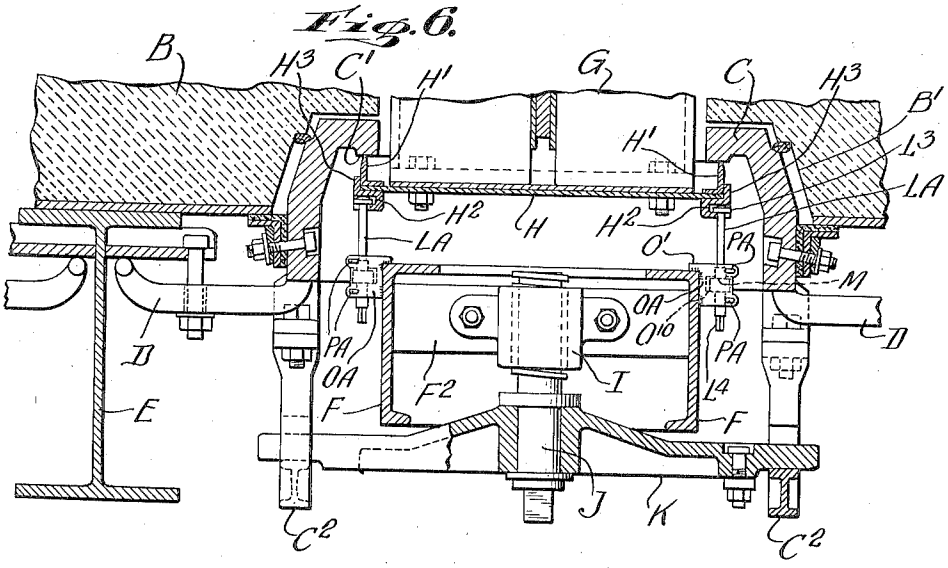
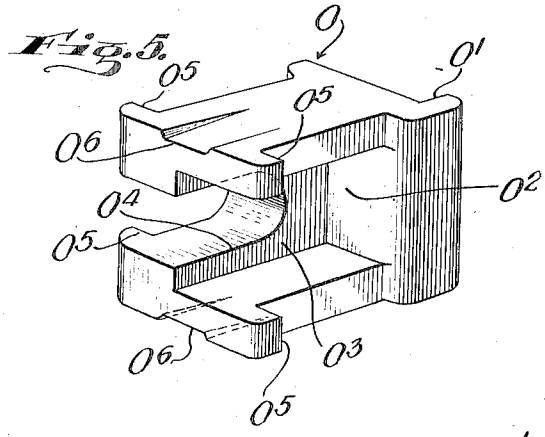


Fig. 5.



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Patented Apr. 15, 1941 2,238,239

UNITED STATES PATENT OFFICE

2,238,239

SELF-SEALING DOOR

Louis Wilputte, New Rochelle, N. Y., assignor, by mesne assignments, to Wilputte Coke Oven Corporation, New York, N. Y., a corporation of Maine

Application June 9, 1939, Serial No. 278,226

7 Claims. (Cl. 202—248)

The present invention relates to self-sealing doors of the kind used to close the ends of horizontally elongated coking chambers of the general type in which practically all metallurgical coke is made.

While other forms of self-sealing coke oven doors have been proposed, in every form of such a door in commercial use, so far as I am aware, the door comprises a multiplicity of sealing member adjusting devices acting between a rigid metallic outer door section and portions of a flexible metallic sealing section, which, in the closed position of the door extends into overlapping relation with a door frame member anchored in the coke oven structure. The adjustable connections are distributed along the margin of the sealing section and are employed to bring the portions of the sealing section which they respectively engage, into proper sealing engagement with the sealing surface of the door, notwithstanding the distortion of the door and door frame practically inevitable under the thermal and mechanical stresses to which they are subjected.

In its most usual form, each adjusting device comprises a threaded bolt or screw which is parallel to the door axis and extends through a threaded opening formed in a flange or lug portion of the rigid door section, or in a bracket part attached to said section. Such threaded adjusting devices, when in good mechanical condition, are quite satisfactory from the operative standpoint, as they permit of any desirable fineness and accuracy of adjustment, and can be readily adjusted by means of a suitable hand wrench. In practical use, however, the adjusting devices are exposed to highly oxidizing weather and temperature conditions, and are also subjected to heavy mechanical stresses. In consequence of corrosion of threaded surfaces or mechanical deformation, it is a common occurrence for an adjusting screw to freeze or bind so tightly in the threaded opening through which it is screwed, that it will not turn under a torque great enough to break the screw. When an adjusting screw is thus broken, it is ordinarily necessary to drill out the portion of the adjusting screw frozen in the threaded opening, and this is relatively expensive and time consuming door repair operation.

A specific object of the present invention is to provide a self sealing coke oven door, with threaded adjusting devices, each of which comprises a nut member detachably connected to the outer section of the door so as to permit of its quick and easy replacement, and each of which is so simple in form and inexpensive to construct that its replacement cost is so small as to be of little practical significance.

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 horizontal section through a coke oven door and the adjacent portion of a coke oven structure in which the door is placed in its closed position;

Fig. 2 is a sectional elevation of an upper portion of the door and adjacent coke oven structure, the upper portion of the section being taken on the line 2—2, and the lower portion on the line 2*a*—2*a* of Fig. 1;

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

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

Fig. 5 is a perspective view of a part shown in Figs. 1–4;

Fig. 6 is a partial horizontal section taken similarly to Fig. 1, but illustrating the use of a modified form of the invention in a door of somewhat different type from that shown in Figs. 1 and 2; and

Fig. 7 is an elevation of parts shown in Fig. 5.

In the drawings, and referring first to the construction shown in Figs. 1–5, A designates one of the coking chambers of a horizontal coke oven battery of conventional type, having heating walls B at the sides of said chamber. The walls B are formed with recesses B′ at the margin of the doorway to receive a cast metal door frame member C which extends around the doorway and is anchored in place by means shown as comprising clamping members D detachably secured to the coke oven battery buckstays E in the manner disclosed in my prior Patent 2,025,967, granted Dec. 31, 1935. The door frame member C is formed at the outer side of its inner edge portion with a sealing surface C′. The surface C′ is customarily a machined plane surface when the door frame is initially installed, but customarily is distorted and becomes non-planar as soon as the door frame is heated up to operating temperatures, and is subject to substantial further distortion in regular use.

As shown, the end of the coking chamber is

closed by a removable door comprising three main sections, namely, a rigid metallic outer section comprising vertical beams F, an inner plug section comprising refractory masses G, and an intermediate sealing member comprising a flexible metal plate body portion H which extends transversely of the door, and in the closed condition of the door, overlaps the door frame sealing surface C'. The sealing member also includes a sealing edge part H' in the form of a rolled metal bar with a flange or base portion along the inner side of the plate H and welded to the latter, and with another flange or web portion extending transversely to the plate and adapted to have its free edge brought into engagement with the sealing surface C'.

In the door construction shown, the outer section beams F are rolled sections connected at their ends, by welding them to end member F' in the form of steel castings, F, only the top end member F'' being shown. The door when in its closed position is suspended from the top of the door frame C by a hook extension *f* of the door top part F''. Intermediate their ends the beams F are connected by one or more, usually two, transverse members F^2 supporting door locking provisions, and are usually connected, also, by other transverse members F^3. The members F^2 and F^3 may be welded at their ends to the beams F.

The door locking provisions associated with the member F^2 shown, comprises a nut I, suitably anchored in said member, and through which a threaded locking bar spindle J is screwed. A locking bar K is swivelled on the outer end of the spindle J, so that its ends may swing into and out of engagement with door retaining hooks C^2 secured to the opposite sides of the door frame C. The outer end of the spindle J is squared for engagement by a wrench for rotating the spindle. With the ends of the bar K in engagement with the hooks C^2, the outer door section may be moved inwardly to establish the proper sealing pressure by suitable rotation of each spindle.

As shown, the flexible sealing plate H is connected to and supported by the rigid outer door section, by a multiplicity of bracket members F^4 which are secured to the inner edges of the beams F by bolts and are welded to the sealing plate H at points intermediate the center line and side edges of that plate, and the plug section refractory masses G, which extend into the oven chamber when the door is in its closed position, are supported by the outer door section through the plate H, all as disclosed in an application for patent of Benjamin A. Freeman, Serial No. 255,418, filed Feb. 9, 1939.

In so far as above described, the door construction illustrated in Figs. 1 and 2, includes nothing claimed as novel herein, but is illustrated as a typical self-sealing door construction, with which sealing plate adjusting devices constructed and arranged in accordance with the present invention may be used with advantage.

In the form of the invention illustrated in Figs. 1–5, each adjusting device comprises a screw or bolt L and a nut M through which the screw L is threaded. In the particular form shown in Figs. 1–5, the screw L comprises an inner end portion L' which is unthreaded, and small enough in diameter to pass through the nut M in which the threaded outer portion of the screw is normally screwed. At its outer end the screw has a head L^2 which is shaped for wrench engagement, and, as shown, is hexagonal. Ordinarily each nut M, may well be of the simple rectangular form shown. In the assembled door, the nut member M of each adjusting device is seated in, and removably secured to, a corresponding supporting lug or part O which may be an integral part of the outer door section, and in a preferred construction is a forging welded to an adjacent portion of the outer door section.

As shown in Figs. 1–5, each part O comprises a base portion extending alongside and welded to a lateral surface portion of the adjacent outer door section F or end section F'', and is formed with a transverse rib or flange O' at its inner side, which overlaps and is welded to an inner surface portion of the adjacent beam F, or end member F''. The member O is formed with a recessed seat O^2 open at the inner side and at the free end of the part O, and adapted to receive a corresponding nut member M. The portion O^3 of the part O, forming the outer wall of the seat O^2, is formed with a horizontal slot or groove O^4, open at the free end of the part O and adapted to loosely receive the body portion of a screw L threaded through a nut M seated in the seat O^2. Advantageously, the two halves of each part O respectively above the horizontal plane passing centrally through the part when disposed as seen in Figs. 3 and 4, are similarly formed so that each part is adapted to be secured to either side as well as at the top and bottom of the door.

In the normal assembled condition of the door, each adjusting device M is detachably secured in the seat O^2 of the corresponding supporting part O, by suitable retaining means, which in the form shown in Figs. 1–4, is in the form of a U shaped spring clip P, with one leg engaging the outer side, and the other leg at the inner side of the corresponding member O. Both legs of the clip are at the side of the corresponding screw L, adjacent the free end of the part O, and are held against movement away from said axis by two shoulder portions O^5 of the part O, one of said parts extending outwardly from the outer side, and the other extending inwardly from the inner side of the part O, at the free end of the latter. The parts may be so relatively proportioned that the inner leg of each clip P will bear snugly against the inner side of an adjacent portion of the corresponding nut M, and the portions of the inner leg of the clip above and below the nut M, as seen in Fig. 3, may also bear against the inner sides of the adjacent portions of the part O. If the side of the nut at the inner side of the door is given camber, as indicated in Fig. 3, the nut will be subject to a wedging action positively opposing its movement away from the door axis, while the clip P is in place and the clip will be held away from the screw L and in engagement with the shoulders, O^5.

The character of the action of the clip P or other retaining means employed is relatively unimportant, however, because its only real function is to prevent an accidental displacement of the corresponding adjusting device, which has its nut member M held by the walls of the corresponding seat O^2 against displacement by the normal operating stresses to which the device is subjected. As is clearly shown, the outward reaction thrust of the nut M is taken by the outer wall O^3 of the corresponding seat O^2, while the transverse seat walls, respectively above and below the rectangularly shaped nut M in the position of the parts shown in Fig. 3, hold the

nut against rotation about the axis of the screw L threaded through it.

However, the practical considerations which make it desirable to provide retaining means such as the clips P, make it practically desirable, also, to so form and dispose those parts as to prevent their accidental displacement, while permitting their ready removal and replacement when necessary. To this end, the two legs of each clip P, in the form shown are outwardly bowed away from one another and the inner and outer sides of the portions of the part O above and below the bolt L as seen in Fig. 3, are similarly inclined in conformity with the manner in which the legs of the clip are bowed, i. e. so that the portions of the part O respectively above and below the bolt L as seen in Fig. 3 are tapered, and diminish in thickness measured in the direction of the length of the bolt with the distance from the latter. With the parts shaped and described, each clip P, if formed of spring steel may be readily put in place by a hammer blow or two, and when in place, is frictionally held in position, and holds the corresponding nut M in snug frictional engagement with the outer wall of the corresponding recess O^2. As shown, each part O is formed with a groove O^6 in each of its upper and lower surfaces, as seen in Figs. 3 and 5, shaped and disposed to receive a screw driver, wedge or other implement which may be used to pry the yoke portion of a clip P adjacent said surface away from the latter, in removing the clip.

As will be understood by those skilled in the art, the various screws L are intended to be so relatively adjusted axially of the corresponding nuts M, that at all points along its length, the sealing edge part H' will be in sealing engagement with the door frame sealing surface when the door is in its closed position, although under normal operating conditions, each door frame sealing surface is distorted from its initial planar condition, to an extent which is appreciable though it cannot be precisely predicted. Furthermore, the outer door section is also subject to some distortion, and while rigid in comparison with the flexible sealing section, may be bent or deflected by the locking force to which it is subject.

In ordinary practice, when a self-sealing coke oven door is returned to its closed position following each oven discharging operation, the proper sealing engagement between the sealing edge of the door and the door frame sealing surface will not be insured, unless the door seating force is sufficient to cause the seating edge to cut through pitch, tar, and furnace dust adhering to the sealing member or door frame and particularly to the latter, as well as through coke which may be interposed between the door and door frame. In consequence of this condition, it is now customary in the operation of coke oven batteries with large, though not abnormally large, coking chambers, in which the coke oven doors may be 12 feet or so in height, to subject each door to sealing force of the order of 25,000 to 30,000 pounds. Such a door may well be provided with 12 adjusting devices at each side and with two such devices at the top and two reaction force with which each nut M will be pressed against the seat O^2 of the corresponding support, will be of the order of 1,000 pounds.

As has been previously explained, a primary object of the invention is to provide a threaded adjusting device of such character that when its threaded parts freeze together as a result of surface corrosion or deformation resulting from the stresses of operation, the defective device may be quickly and easily separated from the door and a properly operative device put in its place. The defective device removed from the door may frequently be put back into good operating condition by a simple, inexpensive machine shop operation, or in some cases, by the replacement of one or the other of its two threaded parts. However, the obviously low production cost of the simple adjusting nuts and screws makes their frequent replacement relatively inexpensive. Furthermore, it is practically feasible to reduce the tendency of the threaded parts to freeze together, by making the screws L of steel and the nuts M of bronze since the nuts M are too small to make their increased cost, when made of bronze rather than steel or cast iron, a matter of real significance.

When the sealing member is anchored to the outer section of the door, as shown in Figs. 1 and 2, or in some still more rigid manner, such, for example, as that shown in the Wolff Patent No. 1,908,501, or that in which the plate portion of the sealing section is clamped between the rigid outer and the inner plug sections of the door, as it is in one of the constructions shown in the Beimann Patent No. 2,126,239, the adjusting screws L are required to exert a thrust action only on the sealing section and need not be positively connected to the latter.

As those skilled in the art will understand, however, the present invention may be used with advantage with self-sealing doors of all types, including in particular the type illustrated, for example, in my prior Patent No. 1,131,829, granted Jan. 9, 1935, in which the sealing member comprises a through plate which extends across the doorway and is bodily movable toward and away from the outer section of the door. In a door of the type last mentioned, each adjusting device is advantageously adapted to exert either a thrust or a pull on the sealing member, as is provided for in the embodiment of the present invention illustrated in Figs. 6 and 7.

As shown in Fig. 6, the adjusting device screws LA are shaped and connected to the sealing member in the manner disclosed in my said prior Patent No. 2,131,829, each screw LA being formed at its inner end with a head L^3 adapted to be inserted in a corresponding undercut open ended groove, or pocket, H^2 formed in a pad or connection part H^3 welded to the flexible sealing plate H. Since the head L^3 of the bolt LA is desirably larger in diameter than the threaded body portion of the bolt, the outer end L^4 of the bolt, which is squared or otherwise shaped for wrench engagement, must be small enough to pass through the corresponding adjusting nut M, which may be exactly like the nuts M previously described.

The adjusting device supporting part OA employed with an adjusting device of the push-pull type, is preferably formed, as illustrated in Figs. 6 and 7, with a seat O^{10}, differing essentially from the previously described seat O, only in that it comprises a portion O^{12} at the inner side of the nut M, as well as a portion O^{11} at the outer side of the nut. The support portion, or seat wall, O^{12} positively holds the corresponding nut M against movement toward the plate H, when the latter is subjected to a pull by the corresponding screw LA.

As previously explained, the character of the

retaining means employed to detachably hold the adjusting devices against accidental displacement is not essential to the attainment of the general purposes of the present invention. Thus, while it is practical to provide a U-shaped clip generally like the previously described clip, which can be sprung into and out of the position in which it straddles and grips the outer end of one or the other of the portions O^{11} and O^{12} of the supporting part OA shown in Figs. 6 and 7, in the construction actually shown in those figures, each adjusting device is held against accidental displacement by two cotter pins PA which extend transversely to the length of the screw LA, and at the outer side of the latter, through openings formed in the ends of the supporting part portions O^{11} and O^{12}.

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

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

1. A self-sealing coke oven door comprising in combination, a flexible sealing member adapted to extend transversely of the door into overlapping relation with a sealing surface at the margin of a doorway closed by the door, a rigid outer door section including integrally connected seat portions having adjusting device seats respectively disposed in front of portions of said member distributed along the margin of the latter, and an adjusting screw engaging a corresponding one of said portions, and a nut through which the screw is threaded and which is removably mounted in the seat in front of the member portion engaged by the screw, each of said seats comprising a bearing surface at the outer side of, and engaged by, the nut seated therein, and adapted to hold said nut against movement in an outward direction relative to said seat and being open at one side to permit movement of the nut in a different direction relative to said seat into and out of the position in which it is seated in said seat, and said seats and nuts being relatively shaped so that each seat is adapted to hold a nut seated therein against rotation about the axis of the screw threaded through the nut.

2. A coke oven door as specified in claim 1, in which each of said seats is in the form of a guideway extending transversely of the door and open at one end for the insertion and removal of an adjusting device nut.

3. A coke oven door as specified in claim 1 comprising means for releasably securing the adjusting device nuts against accidental displacement from the seats in which they are mounted.

4. A coke oven door as specified in claim 1, in which each of said seats is in the form of a guideway extending transversely of the door and open at one end for the insertion and removal of an adjusting device nut, and means for detachably securing a nut in each seat.

5. A coke oven door as specified in claim 1, in which said outer door section comprises a body portion and parts extending transversely away from said body, and each recessed to provide an adjusting device seat having an outer wall adapted to be engaged at the outer side by an adjusting device nut and having walls transverse to and extending inwardly from said outer wall and adapted to engage the opposite edge portions of said nut and hold the latter against rotation about the axis of the adjusting device screw threaded through said nut.

6. A coke oven door as specified in claim 1, in which said outer door section comprises a metallic body portion and metallic seat parts welded to and extending transversely away from said body, and each recessed to provide an adjusting device seat having an outer wall adapted to be engaged by the outer side by an adjusting device nut, and having walls transverse to and extending inwardly from said outer wall and adapted to engage the opposite edge portions of said nut and hold the latter against rotation about the axis of the adjusting device screw threaded through said nut.

7. A coke oven door as specified in claim 1 in which the adjustment device nut receiving seats are each formed with outer and inner walls positively holding the nut seated therein against movement relative to the outer door section toward and away from the sealing member, said walls being formed with slots extending transversely of the door and each open at its end to receive a portion of an adjustment device screw threaded through the nut mounted in the corresponding seat.

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