July 9, 1940. P. VAN ACKEREN 2,207,562

COKE OVEN DOOR

Filed April 28, 1938 3 Sheets-Sheet 1

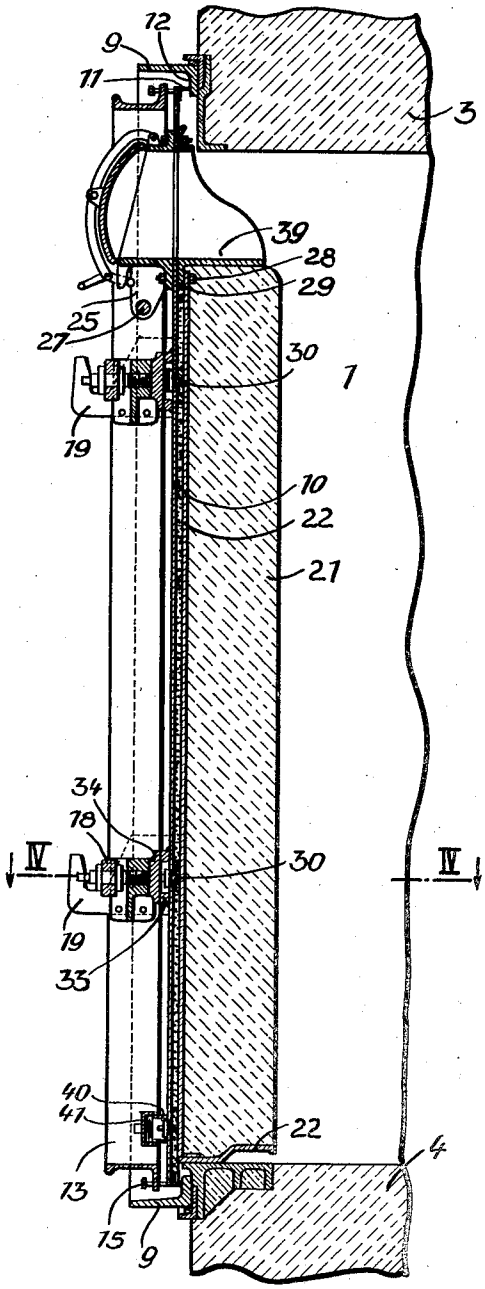


Fig. 2

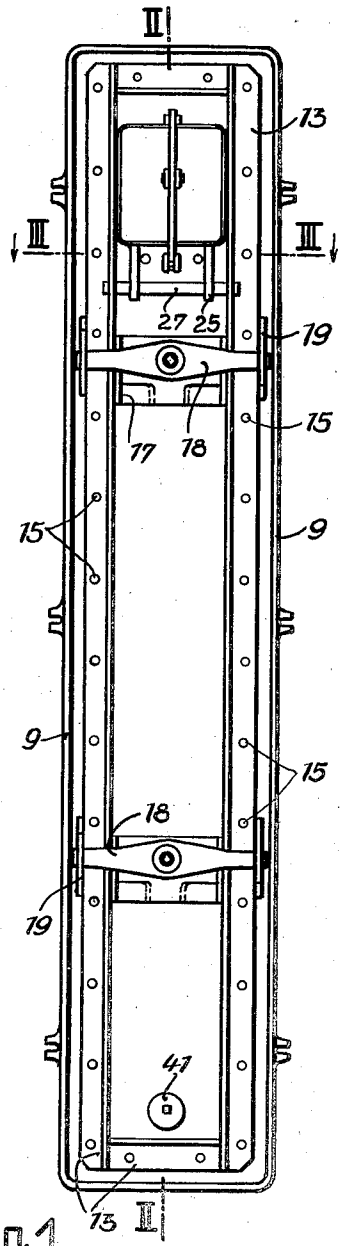


Fig. 1

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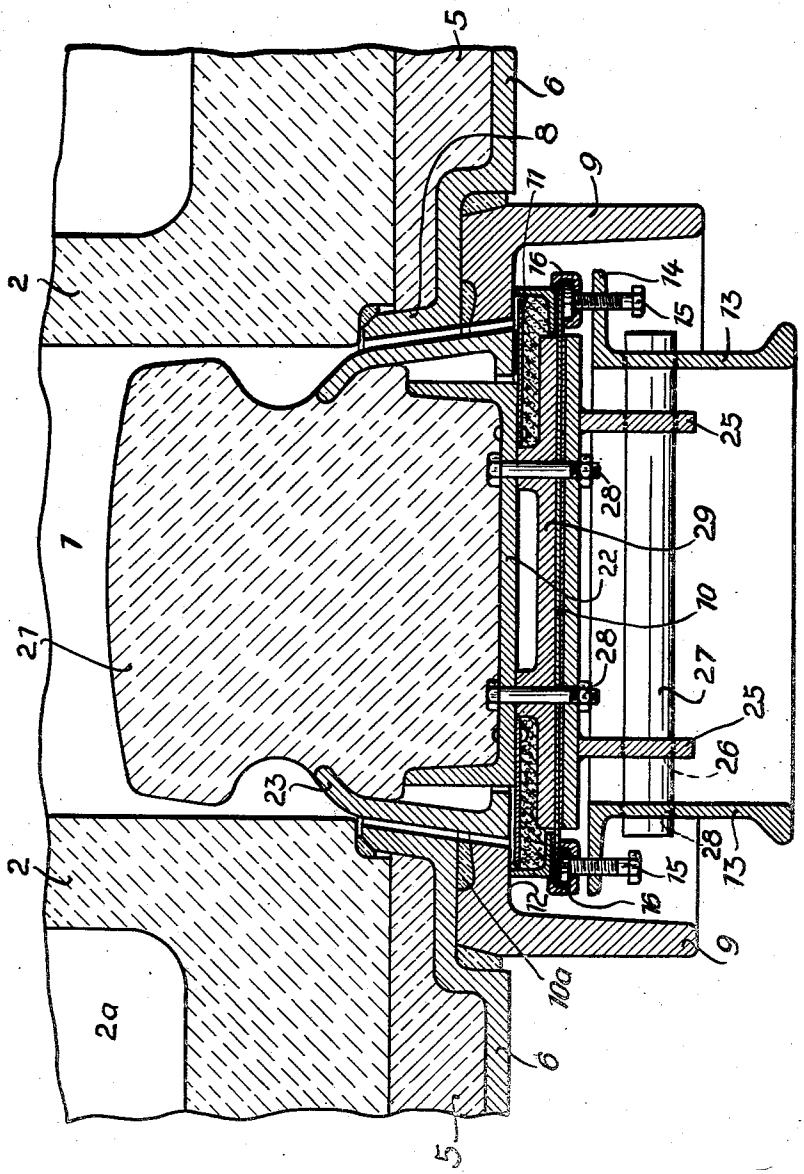


Fig. 3

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COKE OVEN DOOR

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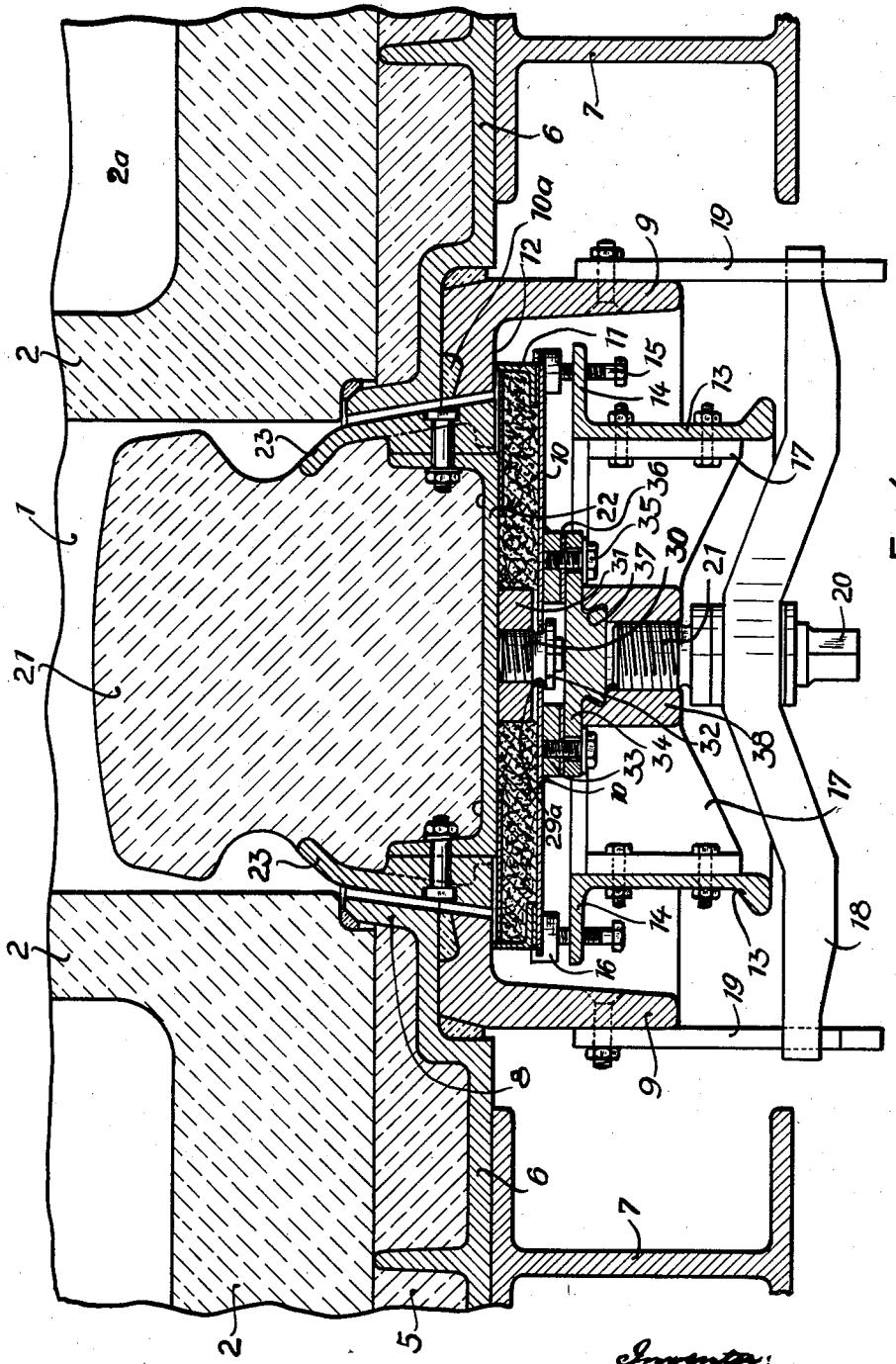


Fig. 4

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Patented July 9, 1940 2,207,562

UNITED STATES PATENT OFFICE

2,207,562

COKE OVEN DOOR

Paul van Ackeren, Essen, Germany, assignor, by mesne assignments, to Koppers Company, Pittsburgh, Pa., a corporation of Delaware

Application April 28, 1938, Serial No. 204,819
In Germany April 29, 1937

4 Claims. (Cl. 202—248)

The present invention relates to door closure means for coke ovens or the like, for instance horizontal chamber ovens for the production of gas and coke, and more particularly to those coke oven doors in which, for sealing the joint between the door and the door frame, there is used an adjustable metallic frame which is pressed against a plane face of the door frame when the door is closed, said adjustable metallic frame being fixed to the edge of a resilient plate of sheet-iron or the like which extends over the whole door opening and which is connected to an outer rigid door body or frame.

Coke oven doors and the like are generally lined with refractory bricks. The refractory brick-lining slightly projects into the coking chamber when the door is in closed position, thus keeping the heat away from the metallic parts of the door. The refractory lining of the door is held by a frame or other members which must be connected with the outer body of the door in a sufficiently strong manner so that it may be withdrawn from the door way when the door is being opened. Furthermore, the outer door body is equipped with locking bars and other means for keeping the door in closed position. With these rigid parts of the door body, which must be very strong, is connected the above mentioned elastic plate carrying the adjustable metallic frame which serves for sealing the door joint.

It would be preferable for this elastic plate to extend fully over the whole opening of the door, as in this way the best sealing can be obtained, and to be firmly connected with the rigid body of the door. The large elastic metallic plate is, however, subjected to considerable changes of shape when it is being heated up to the working temperatures. Consequently, the connection of the plate with the rigid door body should be designed in such a manner that the plate may expand and move as freely as possible.

Now, the main object of my present invention is to provide such improvements in coke oven doors or the like which will allow a proper movement of the elastic metallic plate relatively to the rigid door body without releasing the connection between the outer door body and the inner frame carrying the heavy refractory brick-lining.

The essential feature of my present invention consists in connecting the outer door body, the elastic metallic plate which extends over the whole door opening without interruption, and the carrier frame for the refractory lining situated inside, with one another in such a manner that the carrier frame is connected immovably in the direction of the coking chamber relative the outer door body and the resilient metallic plate, whilst in the longitudinal direction of the door a relative adjustment of the door parts with respect to one another may still take place.

Further, according to my present invention, the three mentioned door parts are connected with one another preferably in such a manner that at one end of the door, for instance at the top, the three parts are firmly connected with each other, and at the other end of the door, for instance at the bottom, the rigid door body and the inner carrier frame are adjustably supported relative to the elastic metallic plate without a direct connection in the longitudinal direction of the door, but they are carried non-adjustably in the transverse direction.

Another important feature according to my invention consists in effecting the adjustable connection between the carrier frame for the refractory brick lining of the door and the elastic metallic plate by means of a cap screw extending through a cut in the metallic plate. The cap screw is fitted into the carrier frame and its head lies in a gas-tight casing arranged at the outside of the elastic metallic plate.

Finally, an essential feature of my invention consists in providing on the outside of the cover of the casing, in which is adjustably arranged the connecting screw for the carrier frame for the refractory lining of the door, a dovetailed projection extending in longitudinal direction of the door, said projection engaging movably a correspondingly conformed claw of the outer rigid door body.

The present invention offers for the first time a proper solution of the problem involved in using a continuous elastic metallic plate to ensure a satisfactory and permanently gas-tight seal for the door opening and at the same time connecting the individual main parts of the doors, i. e. the outer rigid door body, which carries the locking bars and other closing means, the elastic metallic plate, and the inner carrier frame for the refractory bricklining of the door, in such a manner that, on the one hand, a relative movement of the metallic plate, carrier frame and outer door body against one another is rendered possible, corresponding to the heat expansion of the various parts of the door, and, on the other hand, it is not necessary to provide at the connecting points for such purpose any passages designed similarly to stuffing boxes or the like,

which require frequent control and re-adjustment.

With the coke oven doors known hitherto, the connection between the various parts is usually done by making use of stuffing boxes or other resilient packing means, such as asbestos. This is very disadvantageous, especially for the fairly rough operation of the coking plant, as such packing means become loosened very quickly, and if they are not re-adjusted and controlled frequently, they cause gas leakages.

Many other essential objects and features of my invention will be apparent from the following description of a preferred embodiment thereof and may be taken from such description and from the accompanying drawings, in which

Figure 1 is a front elevational view of a door embodying the present invention,

Figure 2 is a vertical section on line II—II of Figure 1,

Figure 3 shows on an enlarged scale a horizontal section on line III—III of Figure 1 and

Figure 4 finally illustrates a horizontal section on an enlarged scale on line IV—IV of Figure 2.

The horizontal chamber of a coking oven has been marked 1 on the drawings, the opening at the side of the horizontal chamber being closed by a door of the present invention. The chamber 1 is formed by the side walls 2, consisting of refractory material and in which are arranged for instance the heating flues 2*a*, the roof 3 and the bottom 4.

The refractory brickwork of the oven is covered on the outside by a layer 5 made of heat-insulating material. The layer 5 is held by the oven armouring 6 consisting of metal plates against which fit the buckstays 7.

At the opening of the chamber, the oven armouring 6 is formed into a frame-like rim 8. The door frame proper 9 is inserted into the cavity of the section 8 and the joints sealed by means of suitable packings 10*a* which can be taken out.

The door to be placed into the door frame 9, is surrounded by an elastic plate 10 which extends over the entire height and width of the chamber opening. On the rim, the plate 10 carries a frame 11 being of V-shaped cross section, the front edge, preferably the knife-like edge rests against a face 12 of the door frame 9 in the closed position of the door.

Under certain conditions, the door frame 9 is exposed to considerable changes in the shape, due to the strong heat radiating from the oven chamber. In order to make a gas-tight seal for the chamber opening, the front knife-edge of the frame 11 must follow fairly exactly the sealing face 12 of the door frame. This can be arrived at if the following contrivance is provided for the purpose on the door:

Outside, in front of the elastic plate 10 of the door, there is arranged an outer rigid frame body or section 13 which is fitted with a continuous sealing edge projection 14 in which are arranged many set screws 15. The head of each set screw 15 is situated in a hook-like casing 16 which surrounds the slightly projecting rim of the elastic plate 10, as shown in Figures 3 and 4. The heads of the set screws 15 can turn within the casing 16 as fully described in the copending application for Letters Patent of Heinrich Koppers, Essen, Germany, Serial No. 199,343, filed April 1, 1938, relating to "improvements in Self-sealing doors for coke ovens or the like," executed on the 21st of March, 1938.

The rigid door body 13 is likewise fitted with the locking means by which the door is kept in closing position. These locking means consist of the bars 18, the ends of which engage behind the hooks 19 which are affixed to the door frame 9. The locking bars 18 are carried by set-screws 20, the threaded end 21 of which engages in suitable threaded holes in the webs 17 of the rigid door body 13.

The inside of the door is fitted with a refractory lining 21. This lining is carried by a U-shaped section 22 to which are fastened at both sides the clamps 23 which surround the sides of the rafractory lining 21. At the bottom, the refractory liner 21 is kept in place by the lower part 24 of the carrier-body 22.

The connection between the three main parts of the door, the carrier frame 22 for the refractory door lining, the elastic metallic plate 10, and the rigid door body 13 situated outside, is performed as follows:

At the upper part of the door plate 10, there are affixed two projections 25 each having a bore 26 through which extends a supporting pin 27. The ends of the supporting pin 27 extend through suitable bores 28 in the outer rigid door body 13. Near the projections 25, the metallic plate 10 is firmly connected with the main girder 22 for the refractory lining 21 by means of the screws 28 and by the insertion of a distance piece 29. The three main parts of the doors are, therefore, interconnected substantially rigidly in the upper part of the door.

In the middle and in the lower part of the door, however, the connection is flexible. The elastic plate 10, therefore, is provided with several cuts 29*a* which are intersected by a screw 30 each of which is bolted into a projection 31 of the main girder 22 for the refractory liner of the door. The screw 30 is fitted with a projecting head 32 which surrounds the rim of the opening 29*a* of the metallic plate in such a manner that the screw 30 can move forward and backward relatively to the metallic plate 10 in the longitudinal direction of the door, but the screw cannot be drawn back from the cut of the metallic plate 10.

The head of the screw 30 is situated in a gas-tight casing which is formed by a frame-like projection 33 on the metallic plate 10 and a lid 34 which are firmly interconnected through the screws 35 and by the insertion of a packing 36.

The head 32 of the screw 30 can be moved forward and backward within the casing. Thus, a relative movement of the main girder 22 as against the continuous metallic plate 10 is rendered possible without affecting the gas-tight seal of the metallic plate 10 by this relative movement.

Suitably, the lid 34 is arranged so that it lies within the range of the webs 17 of the outer rigid door body 13. The lids 34 each have a dovetailed projection 37 which extends in longitudinal direction of the door. This projection 37 is surrounded by the suitably designed middle part 38 of the webs 17 in such manner that the web part 38 can move against the lid 34 in the longitudinal direction of the chamber, but the part 38 does not leave the dovetailed projection 37.

The three main parts of the door are therefore firmly interconnected at the upper end of the door if carried out according to the present invention, whereas in the centre and at the lower end of the door, they are connected with one another in such a manner that they can allow a

relative movement in the longitudinal direction of the door but not transversally so that all parts of the door can move in conformity with the heat expansion. It is understood that also the casings 16 of the set screws 15 can move relatively to the edge of the plate 10.

Instead of arranging the rigid connection of the three main parts of the door at the upper door end, it may also be of advantage to provide for this connection being in the lower part of the door.

Furthermore, it is possible to have the projections 25 of the door on the casing 39 for the levelling hole, as shown in Figure 2. Figure 2 further indicates that a third flexible connection, as by means of the screw 30, is also arranged at the lower end of the door between the main girder 22 for the refractory door stopper and the elastic metallic plate 10. The casing 40 for the head of the lower connecting screw 30 is closed by a cap 41.

The connection of the main parts of the doors as described in the foregoing, ensures a proper transfer of pressure and pulling stresses acting upon the doors when they are opened and closed. If, for instance, a pressure is exerted upon the outer rigid door body 13, when the door is inserted into the door frame by means of the usual door manipulating machine of coke ovens, the pressure from the frame 13 is transmitted through the webs 17 onto the lid 34 which is firmly connected with the metallic plate 10, thence through the medium of the distance piece 31 to the main girder 22 for the refractory lining 21. If, on the other hand, a pulling force is exerted upon the rigid door frame 13, for instance when opening the door, then the pulling force is transmitted across the webs 17 onto the dovetailed projection 37 and the lid 34 and its screws 35 onto the projections 33 of the metallic plate 10 and from there across the projecting head 32 of the connecting screw 30 onto the main girder 22 of the refractory lining of the door.

Since no sealing elements, such as stuffing boxes or the like, are provided according to my present invention, the door is always kept gas-tight during the sealing of the coking operation, notwithstanding the movements of the individual door parts, caused by the heat expansion or manipulation of the door.

I have now above described the present invention on the lines of a preferred embodiment thereof, but my invention is not limited in all its aspects to the mode of carrying it out as described and shown since the invention may be variously embodied within the scope of the following claims.

I claim:

1. In a self sealing door comprising an intermediate flexible metallic plate-like body section having an inwardly extending rim portion terminating in a sealing edge, an inner refractory plug section, an outer rigid frame section carrying an annular row of tightening devices for conforming the sealing edge to a door frame therefor, and means for holding the outer rigid frame section to the door frame, the three sections being connected together for operation as a unitary whole, the combination of adjustable means for adjustably connecting said sections relative to each other, said means comprising an adjustable spacing element extending through a freely encircling cut-out portion of the flexible plate, and seated on the plug section to set the plug section relative to the plate section, the head of the adjustable spacing element lying outside the sealing plate in a gas tight casing to hold the setting of the plug section, said casing lying on the outer side of the sealing plate and being firmly secured thereto.

2. A self sealing door as claimed in claim 1 and in which the adjustable spacing element is a cap screw, and in which the head of the screw overlaps the rim of the cut-out portion, and the rim fits loosely in an annular groove therefor in the shank of the screw inside the screw head.

3. A self sealing door as claimed in claim 1 and in which the outer surface of the casing for the adjustable spacing element is connected to the outer rigid frame section by an annular loose dovetail joint adapted to accommodate relative movement between the outer rigid frame section and the casing in a direction substantially normal to the door.

4. A self sealing door as claimed in claim 1 and in which the three sections are rigidly connected with each other against relative movement only at the upper end of the door.

PAUL VAN ACKEREN.