March 17, 1959 P. E. H. FORSANS 2,878,170

SEALING MEANS FOR THE HYDRAULIC JOINT OF A COKE OVEN DOOR AND FOR LIKE CLOSURES

Filed Oct. 24, 1955 3 Sheets-Sheet 1

FIG. 1

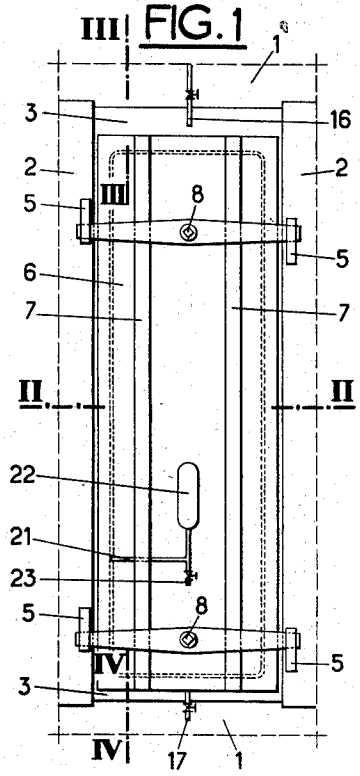


FIG. 3

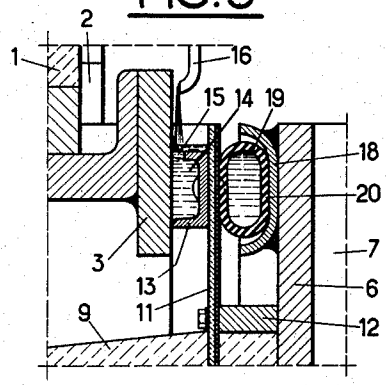


FIG. 4

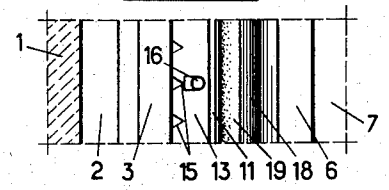


FIG. 2

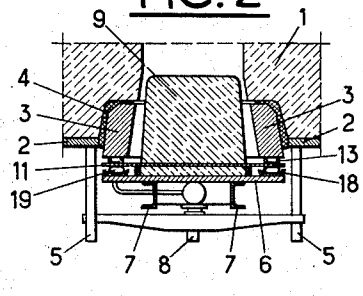
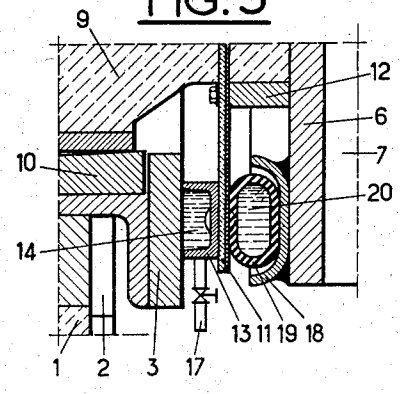


FIG. 5



INVENTOR
Pierre E. H. Forsans

By Holcomb, Wetherill & Brisebois
ATTORNEYS

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FIG.6

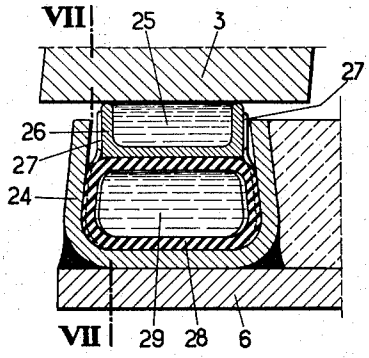


FIG.7

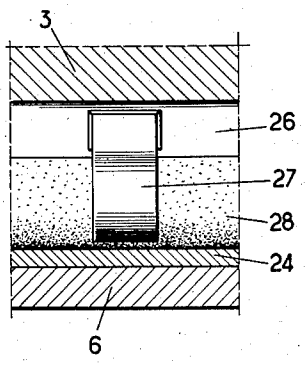


FIG.8

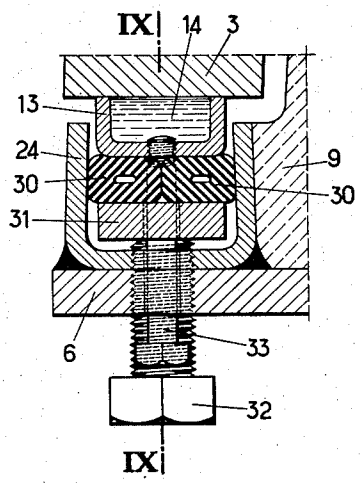
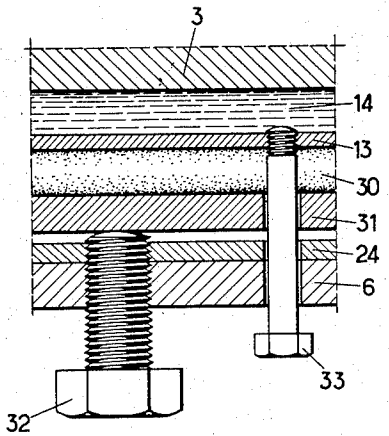


FIG.9



INVENTOR
Pierre E. H. Forsans
By Holcomb, Wetherill & Brisebois
ATTORNEYS

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FIG. 10

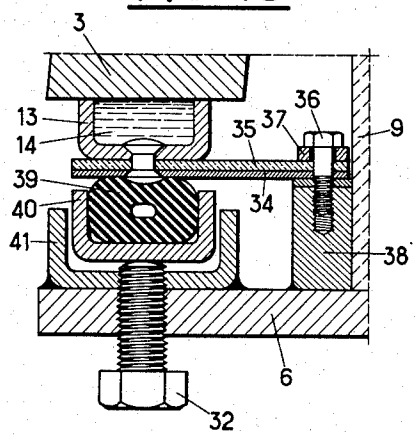


FIG. 11

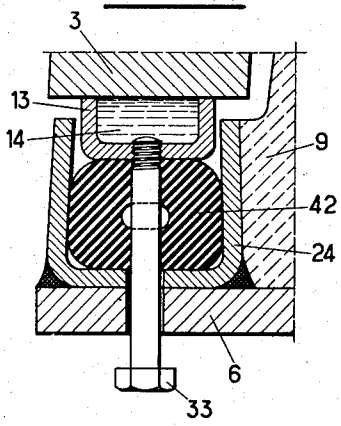


FIG. 12

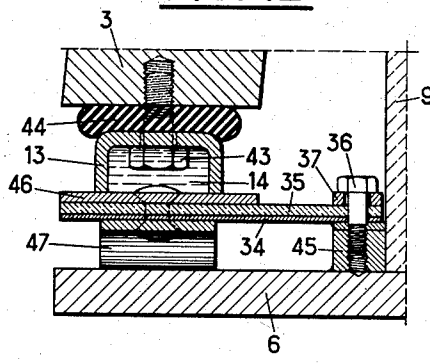


FIG. 13

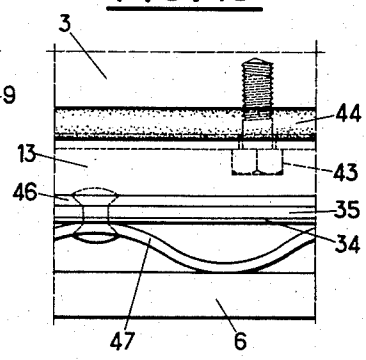
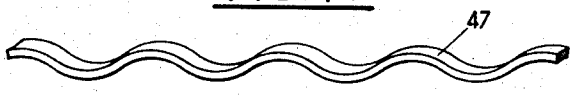


FIG. 14



INVENTOR

Pierre E. H. Forsans

By Holcomb, Wetherill & Brisebois

ATTORNEYS

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SEALING MEANS FOR THE HYDRAULIC JOINT OF A COKE OVEN DOOR AND FOR LIKE CLOSURES

Pierre Eugène Henri Forsans, Cannes, France

Application October 24, 1955, Serial No. 542,402

13 Claims. (Cl. 202—247)

The object of my invention is to provide means for hydraulically sealing a coke oven door or for hydraulical-sealing a like closure designed to separate an enclosed chamber from its immediate surroundings or from another enclosure.

The hydraulic joint embodying my invention is characterized by the fact that it comprises an edging provided along its entire periphery with a groove in the form of a channel which is open towards the outer surface of the edging; cooperating abutment means having a substantially plane continuous surface engaging the sides of the channel; means for tightly attaching this edging and this abutment means, one to the periphery of the opening of an enclosure and the other to the door adapted to close said enclosure; preferably, but not necessarily, resilient means to retain and press said edging and abutment means against each other when the door is closed; and means for leading a sealing liquid into said channel together with means for regulating the circulation of the liquid therein and its removal therefrom.

Several means for carrying out the invention will now be described, purely by way of example, without limiting the invention to these particular embodiments to the exclusion of others. The description refers to the attached drawings in which:

Figure 1 is an elevational view showing a coke oven door together with a part of the front of the oven;

Figure 2 is a fragmentary horizontal cross-section taken along the line II—II of Figure 1;

Figure 3 is a vertical cross-section taken along the line III—III of Figure 1, but drawn on a larger scale;

Figure 4 is a partial plan view of the door corresponding to the portion shown in Figure 3;

Figure 5 is a partial vertical cross-section taken along the line V—V of Figure 1, but on a larger scale;

Figure 6 is a transverse cross-section of a second joint embodying my invention;

Figure 7 is a partial longitudinal cross-section taken along the line VII—VII of Figure 6;

Figure 8 is a transverse cross-section of a third joint embodying my invention;

Figure 9 is a partial cross-section taken along the line IX—IX of Figure 8;

Figures 10 and 11 are partial transverse cross-sections of two other types of joint embodying my invention;

Figure 12 is a partial transverse cross-section of yet another hydraulic joint embodying my invention;

Figure 13 is a partial side view of the sealing means shown in Figure 12; and

Figure 14 is a perspective view of a waved spring forming part of the sealing means, shown in Figures 12 and 13.

On the drawings like reference characters refer to like parts throughout the several views.

In the embodiment shown in Figures 1–5, reference numeral 1 indicates the front of an oven, the embrasure of which is reinforced by the plates 2 and provided with

a jamb 3. This jamb 3 serves as an abutment against which the door closes and the joint between it and the embrasure of the oven is sealed by a packing 4. The plates 2 carry locking bars or staples 5. The frame 6 of the door leaf is reinforced by bars 7, and is provided with a screw type lock 8, which carries a transverse bar which may be caught behind the staples 5. The door is provided with a refractory lining 9 which comes to rest against a sill plate 10 on the furnace (see Figure 5).

The frame 6 of the door leaf carries a cover or flexible plate 11 fixed to the frame through spacing blocks 12 (see Figures 3 and 5).

The elements hereinbefore mentioned are already well known in connection with conventional methods of construction and it is not believed that it is necessary to describe them in further detail.

In accordance with the invention an edging 13 is tightly fixed to the flexible cover 11 and consists of a channel member having a U-shaped cross-section, the free edges of which are adapted to rest on the cooperating front surface of the door jamb 3.

In this position, the channel formed by the member 13 is closed and may be filled with a suitable liquid 14—water, oil, or the like—which insures sealing of the door joint (between the furnace and the outside atmosphere) in a manner which is the more efficacious when the depth of the liquid (which corresponds to the space between the branches of the U-shaped channel member) is greater.

The liquid 14 which forms the seal is brought to the upper part of the channel member 13 through a tube 16 and flows into the space between the cover 11 and the jamb 3, thence into the space between the arms of the channel member through notches 15, in the upper arm of the channel member. A lower tube 17 connected to the lower arm of the channel member 13 is provided with an outlet tap which permits either the establishment of a circulation of liquid while so regulating its flow that it corresponds to the flow through the inlet tube 16, or the complete stoppage of the flow of sealing liquid the level of which is then maintained through the admission of additional fluid through the tube 16, when this necessary.

While it has not been considered necessary to illustrate this alternative construction, the notches 15 may be eliminated and the tube 16 connected in a water-tight manner to the upper arm of the channel member 13 (just as the tube 17 is attached to the lower arm). This arrangement permits the establishment of a circulation of liquid under a desired pressure which may be regulated by well known means. In this case it is possible to provide notches in the inner arm of the lower cross member of the channel member 13 in order to permit cooling liquid to flow into the inside of the furnace, for vaporization or other purposes.

In the first embodiment of my invention a uniform pressure is exerted on the entire periphery of the channel member 13 by means of a flexible tube 19 filled with a liquid 20 under suitable pressure. The tube 19 is mounted in a grooved member 18 fixed to the frame 6 in any suitable manner. The tube 19 is normally circular in cross-section but is flattened when the frame 6 of the door is clamped tight in its closed position, so that the tube 19 presses against the cover 11 directly behind the area to which the channel member 13 is attached. To offset any variations in the volume of the tube 19, it is connected by any suitable means to a tube 21, which is in turn connected to a storage reservoir 22 holding a certain volume of air under pressure which forms a yielding cushion of air. The liquid under pressure may be fed to the elements 19, 21 and 22 through a tube 23

which may be provided with a regulating valve and connected by any suitable means to a source of liquid under pressure. By reason of this arrangement the pressure exerted on the periphery of the channel member is practically uniform throughout its length, and is self-regulating.

Figures 6 and 7 relate to a second embodiment of my invention in which the frame 6 of the door is provided, along its entire inner periphery, with a channel member 24 fixed thereto by any suitable means. The channel member 24 holds a flexible tube 28 resting in the bottom of the channel. A second channel member 26 is seated on the tube 28 and held in place by the small resilient arms 27 seated in the bottom of the channel 24, against which they are pressed by the tube 28 containing the liquid under pressure 29. The channel member 26 serves the same purpose as the corresponding member 13 already described and is urged against the jamb 3 by the tube 28. Reference numeral 25 designates the liquid which fills the channel in member 26 and assures a seal between the inside of the furnace and the outer atmosphere.

The other embodiments of my invention hereinafter described are not equipped with tubes analagous to the flexible tubes 19 and 28 which press the channel of the hydraulic joint against the cooperating surface, and thus avoid the problems posed by their operation.

The embodiment shown in Figures 8 and 9 comprises a channel member 24 fixed to the edge of the inner side of the frame 6 of the door, by welding for example. Reference numeral 13 indicates a channel member, 3 the jamb engaged by the sides of the channel member 13, and 9 the refractory lining of the door.

The channel member 13 rests on the continuous strips 30 of elastic material, such as rubber, neoprene, or the like, and these strips 30 form a tight joint between the sides of the channel member 24 and the bottom of the channel member 13. The strips 30 rest on a sheet 31 which runs the length of the channel 24 and rests on the screws 32 screwed into the frame 6, about which they are regularly spaced. The channel member is mounted on the screws 33, equally spaced about the frame 6 and passing loosely through suitable orifices in the frame 6, the channel member 24, and the sheet 31, as well as the strips 30. The strips 30 are preferably axially hollow so as to have a tubular form which adds to their flexibility. The liquid forming the hydraulic joint is indicated as hereinbefore by reference numeral 14.

When the door of the furnace is opened, the strips 30 which were flattened between the channel member 13 and the sheet 31 revert to their normal cross-section and urge the channel member 13 outward, drawing with it the screws 33, the shanks of which serve as supports and guides in the corresponding orifices in the frame 6 and its channel member 24. These bolts also serve as guides for the sheet 31. These screws permit regulation of the position of the sheet 31, and consequently the pressure applied to the strips 30 when the door is closed. The strips 30 thus exert a steady, adjustable pressure against the entire length of the channel member 13, just like the hydraulic pressure utilized in the flexible tubes 19 and 28 in the two embodiments previously described.

Figures 10 and 11 show two other embodiments of the invention in which the channel member 13 forming the hydraulic joint is supported by a flexible strip of resilient material like the strips 30 already described.

On Figure 10 it will be seen that an edge member having a U-shaped cross-section is welded to the frame 6 of the door. (This edge member could be attached in any other suitable manner.) Screws 32 screwed into the frame 6 and its edging 41 support a channel member 40 in an adjustable position. An elastic strip 39 rests in the channel 40 and is preferably axially hollow. A flexible cover 34—35 of a known type is attached to an edging 38 welded to the frame 6 by means of bolts 36 bearing on a sealing strip 37. The channel member 13 is attached to the cover 34—35 by any suitable means, while the strip 39 resiliently urges the cover 34—35 and the channel member 13 against the cooperating surface of the jamb. The screws 32 permit regulation of the pressure on the periphery of the cover 34—35. Reference numeral 14 indicates the liquid forming the hydraulic joint which is carried in the channel of the member 13.

The construction of the embodiment shown in Figure 11 is especially simple. This comprises an edging forming the channel 24 and welded or otherwise attached to the frame of the door; an axially hollow resilient strip; an edge member 13 having a U-shaped cross-section forming a channel for the liquid 14 in the hydraulic joint; screws 33 mounted in the member 13 to support and guide it, the shanks of these screws engaging in corresponding orifices in the elements 6, 24, 42, sufficiently loosely to permit the screws to slide therein.

Figures 12, 13 and 14 show a sixth embodiment in which the positions of certain elements are reversed. The channel member 13 which carries the liquid 14 to form the hydraulic joint is mounted on the jamb by means of screws 43 bearing on a sealing strip 44 of asbestos or some other suitable material. The frame 6 of the door leaf having a refractory lining 9 and a flexible cover 34—35 of a known type is attached to it by means of screws 36 which pass through a sealing strip 37 and extend into an edge member 45 fixed to the frame 6. The flexible cover is provided on one side with an edge plate opposite the channel member 13 and serving as an abutment therefor. On the opposite side the cover 34—35 is provided with corrugated springs which bear against the inside of the frame 6. These springs 47 are short and are fixed to the elements 34, 35, 45, end to end, with a certain play, to facilitate their compression or extension, and follow the outline of the channel member 13 in such a manner as to form continuous elastic means which press against the edge plate 46 to maintain it, when in closed position, firmly pressed against the edge of the arms of the channel member 13, the springs 47 serving the same purpose as the resilient strips 30, 39 or 42 already described.

The sealing means which constitutes my invention may be embodied in specific constructions other than these herein illustrated without modifying its essential characteristics. Thus the channel member carrying the sealing liquid may be fixed to the furnace instead of to the door, the element which serves as an abutment therefor being then fixed to the door as shown in the embodiment described with reference to Figures 12–14. The means for exerting resilient pressure against the hydraulic joint may be of any suitable type and, specifically, may consist of helical springs or hydraulic jacks, judiciously spaced. These pressure means may also consist of simple screws acting through an intermediate auxiliary resilient element on the channel member of the hydraulic joint or on the edge member serving as an abutment therefor.

I claim:

1. A hydraulic joint for tightly sealing a coke-oven door element against an embrasure element comprising a metallic channel member fixed to and encircling the edge of one of said elements and open toward the other element, said other element being provided with a metallic abutment surface adapted to close over said channel member when the two are brought into contact so as to form therewith a liquid-tight passageway, pressure means for urging said channel member and abutment surface together, a supply of sealing liquid, and means for introducing said liquid into said passageway when the door is closed, whereby any escape of burning gases from the coke-oven door is totally prevented.

2. A hydraulic joint as claimed in claim 1 in which said pressure means is rigid.

3. A hydraulic joint as claimed in claim 1 in which said pressure means consists of a rigid member acting through resilient intermediate means.

4. A hydraulic joint as claimed in claim 1 in which said channel member is fixed to the door and the abutment surface to the embrasure.

5. A hydraulic joint as claimed in claim 1 in which said pressure means comprises a flexible tube containing a liquid under pressure.

6. A hydraulic joint as claimed in claim 1 in which said pressure means consists of a resilient tube.

7. A hydraulic joint as claimed in claim 1 in which the upper side of said channel member at the top of the door is provided with notches through which said sealing liquid is admitted to said passageway when said door is closed.

8. A hydraulic joint as claimed in claim 1 in which liquid tight connections are provided at the top and bottom of the door through which the sealing liquid is admitted to said passageway so as to permit its circulation about the door.

9. A hydraulic joint as claimed in claim 1 in which the channel member is notched along its inner edge to permit the passage of liquid to the space beyond the door.

10. A hydraulic joint as claimed in claim 1 in which the channel member is seated on resilient sealing means in a second channel member attached to said door.

11. A hydraulic joint as claimed in claim 1 in which the door comprises a rigid leaf frame and a flexible cover on the inner side thereof, said channel member being mounted on the flexible cover and said pressure means between said leaf frame and flexible cover to urge the edges of said cover, and consequently said channel member, towards said abutment surface.

12. A hydraulic joint as claimed in claim 1 in which the channel member is fixed to the embrasure and the door comprises a rigid leaf frame and a flexible cover on the inside thereof which carries said abutment member.

13. A hydraulic joint as claimed in claim 1 in which said sealing liquid is water.

References Cited in the file of this patent

UNITED STATES PATENTS

871,421	Koppers	Nov. 19, 1907
1,833,494	Otto	Nov. 24, 1931
1,918,860	Mintner	July 18, 1933
2,478,215	Van Ackeren	Aug. 9, 1949
2,606,865	Forsans	Aug. 12, 1952
2,703,250	Wolff	Mar. 1, 1955

FOREIGN PATENTS

422,182	Great Britain	Oct. 3, 1933
430,446	Great Britain	June 19, 1935
965,801	France	Feb. 22, 1950
863,185	Germany	Jan. 15, 1953
1,062,650	France	Dec. 9, 1953
906,687	Germany	Mar. 18, 1954
1,087,455	France	Aug. 25, 1954