Jan. 24, 1967 A. V. ALEXEFF ET AL 3,299,574

VAPOR-TIGHT THERMAL INSULATING DOOR

Filed Oct. 7, 1964

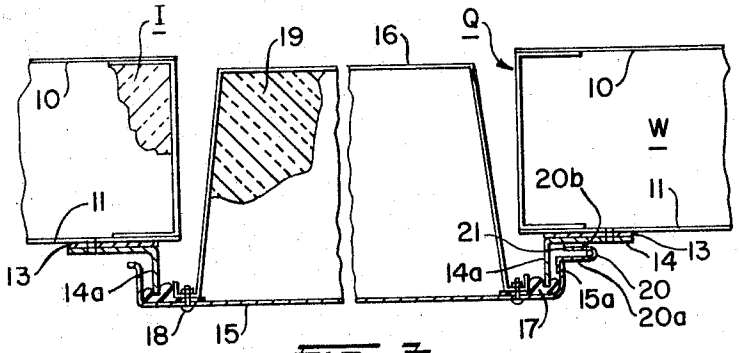


Fig. 3

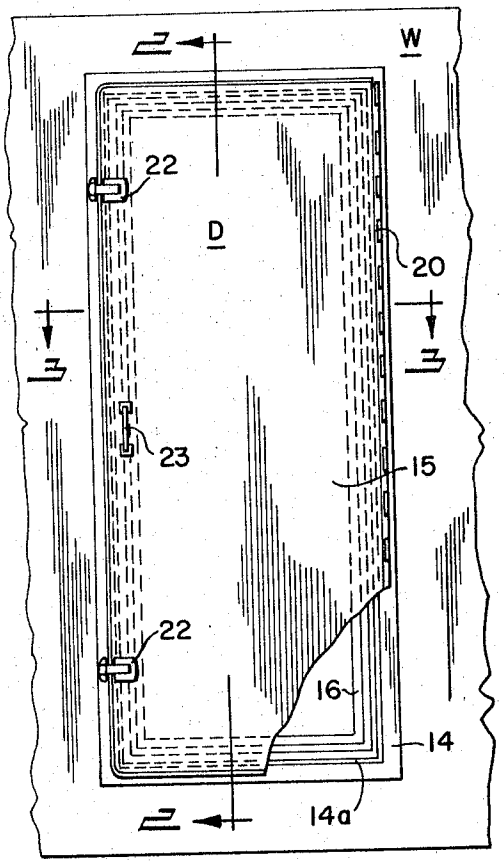


Fig. 1

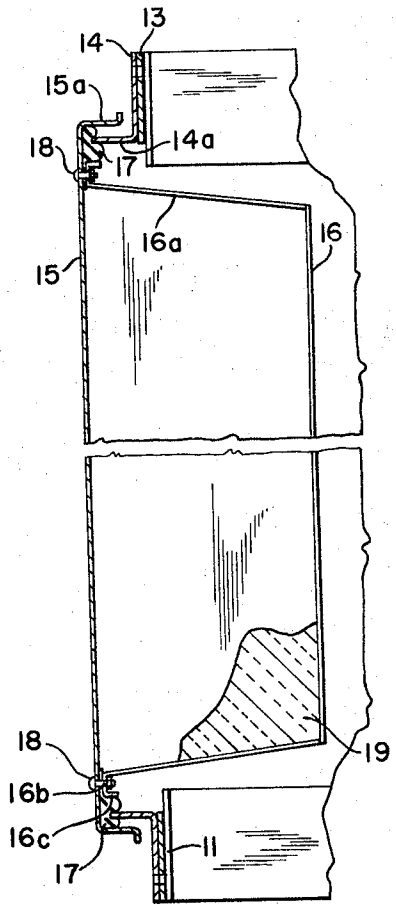


Fig. 2

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United States Patent Office 3,299,574 Patented Jan. 24, 1967

3,299,574

VAPOR-TIGHT THERMAL INSULATING DOOR

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Filed Oct. 7, 1964, Ser. No. 402,095
6 Claims. (Cl. 49—401)

The present invention relates to an improved door structure and, more particularly, to a vapor-tight thermal insulating door adapted to withstand elevated temperatures without warping.

Heat treating chambers are needed for many industrial applications. Closures for such chambers often must meet rather severe requirements. For example, closures, such as doors for ovens, must be vapor-proof to contain within the chamber explosive, noxious or toxic vapors from volatile solvents and the like. Leakage of even minute quantities from a chamber can be dangerous to operating personnel because of potential asphyxiation or explosion.

One serious problem in door structures for the purpose indicated is warpage inflicted principally by exposure to elevated temperatures extant within the chamber. Temperatures of 600° F. or higher within a heating chamber cause extreme warping of a door face and therefore make realization of a proper sealing difficult. In prior doors that depended for structural support on a "deep" section of a door part, or what may be referred to as a door "pan," such a pan or like element was normally fabricated from sheet material having a relatively thick wall section.

It has now been found that a door structure of the conventional type just described leads to high heat conduction and is directly responsible for considerable warping of the face of the door. In accordance with the present invention, a structural member defining an "inner" door pan is employed which is of relatively thin gauge as compared to an "outer" door pan. Substantial improvements result, including a reduction in heat transfer through the door with attendant lessening of warpage.

It is, therefore a principal object to provide an improved closure structure for a heating chamber.

Another object is to provide an improved door structure for an oven and the like capable of withstanding elevated temperatures without warpage.

A further object is to provide a door structure of relatively simple but rigid construction that has lesser heat transfer than prior door structures employed for a similar purpose.

Other objects and advantages are apparent from the following drawing and description wherein:

FIGURE 1 is a front elevational view, partly broken away, of a door of the present invention mounted with respect to an oven wall or the like, and

FIGURES 2 and 3 are sections of FIGURE 1 on the lines 2—2 and 3—3, respectively.

In general, the present door structure comprises two internesting door pans of differing gauge and depth which are, moreover, substantially insulated from each other and from a surrounding supporting structure such as a door frame.

More particularly, in one form the outermore of the two door pans (with respect to a heating chamber) is constructed from relatively thick sheet material and shaped with a relatively shallow depth. The inner door pan comprises relatively thin sheet material and is shaped with a relatively deep depth. The two door pans direct their sides toward one another in a nesting, partially overlapping relation. A vapor seal prevents direct contact between the two door pans.

Referring to the drawing which illustrates a presently

preferred embodiment, the door structure generally indicated at D mates with a rectangular opening O in a metal wall W. The wall structure is not part of the present invention and may comprise any of those known in the art for heating chambers. To facilitate consideration of the illustrated embodiment, the wall W is shown as comprising spaced apart metal sides **10** and **11**, joined at adjacent ends to define the opening O and preferably containing insulation I between them. A continuous asbestos strip **13** extends around and is suitably secured to the periphery of the opening O along the outward side **11** of the wall W against which the door structure may actually abut.

With more particular reference to the door structure D, a metal door angle frame **14** likewise borders the entire periphery of the opening O by contacting the asbestos strip and is suitably secured as by bolts to the side **11** of the wall. The frame **14** has an outwardly extending flange **14***a*. The door D is mounted for opening away from the wall W and includes two door pans **15** and **16**. Door pan **15** is fabricated from relatively thick sheet material such as sheet metal. It is of U-shaped cross-section in both longitudinal and transverse axial directions with relatively short leg portions or flanges **15***a* of uniform length. The "pan" of door pan **15** is therefore relatively shallow. Door pan **16** is fabricated from relatively thin sheet material such as sheet metal. It is also of U-shaped cross-section in both longitudinal and transverse axial directions but with relatively long flanges or leg portions **16***a* of substantially uniform length. The "pan" of door pan **16** is therefore relatively deep. The ends of the leg portions **16***a* of door pan **16** are bent back to form lands **16***b* and **16***c* for a purpose hereinafter described. Door pans **15** and **16** are mounted with respect to each other with their respective leg portions partially telescoping one another (FIGURES 2 and 3), so that in the form illustrated, leg portions **15***a* are exterior to leg portions **16***a*.

Gasket means **17** is interposed between the two door pans. As illustrated such a gasket extends continuously around the periphery of the door pan **15** adjacent its flange or leg portion **15***a*. The gasket means may take the form of a "rope," that is, an insulating fibrous mass encased in an elastomeric sleeve. Such means is known in the art and therefore is not here described in detail. For example, such gasket means can be referred to in the art as "tadpole tape."

The gasket means (FIGURE 2) insulates and isolates the two door pans from each other. The two lands **16***b* and **16***c* of door pan **16** are particularly adapted to seat against the resilient gasket, land **16***b* forming an area through which to attach door pan **16** to door pan **15** by bolts **18**. Heat conductance between the two door pans is reduced by the interposition of the gasket means, although this reduction may be compromised somewhat by conductance through the bolts **18** that fasten the door pans together. The gasket means **17** sealingly receives the flange **14***a* of the door frame. Door pan **16** with its relatively great depth also contains heat insulating material **19**, such as bonded glass fibers or asbestos.

The door D is hinged through door pan **15** to and along one side of the door frame **14**. A standard piano hinge **20** may be used for this purpose. One fold **20***a* (FIGURE 3) of the hinge has a turned end section secured as by welding to the adjacent flange or leg portion **15***a* of door pan **15**; while the other fold **20***b* of the hinge is similarly secured to an overlap strip **21** fixed to the door frame **14**. Explosion latches **22** and a handle **23** may, if desired, also be employed in the door structure.

Merely to illustrate, the approximate dimensions of one specific door installation were as follows: door pan **15** was fabricated from 15 gauge steel and measured on

its face 5 feet, 2.25 inches by 1 foot, 11.25 inches. The leg portions **15***a* were about 1 inch long. Door pan **16** was fabricated from 20 gauge steel and measured on its open face about 4 feet, 11.75 inches by 1 foot, 8.75 inches. The leg portions **16***a* were about 6 inches long.

In the illustrated closed position of the door, the door pan **16** of much thinner gauge sheet material and greater depth, as compared with door pan **15**, occupies a substantial volume of the opening O. The gasket means **17** not only insulates and isolates door pan **16** from door pan **15**, but it also sealingly receives the flange **14***a* of the door frame.

The advantages of the present door structure may, without limitations, be summarized as follows:

(1) The door may be completely assembled at one station.

(2) The door is self-supporting.

(3) The rigid angle frame **14** may be bolted directly onto oven panels or the like.

(4) The door frame and door pans are isolated from the oven panels by means of a gasket which minimizes heat flow into the door frame.

(5) The flanges (on the outer door pan) impart rigidity to the door structure.

(6) The door is also insulated from the frame by means of the gasket.

(7) The relatively thin gauge of the inner door pan reduces heat transfer flow to the door.

(8) A piano type hinge contributes to making the door and frame one single, substantially rigid assembly.

(9) The overall result is an explosive-proof, vapor-tight door of simple, yet rigid construction.

While the foregoing describes a presently preferred embodiment, it is understood that the invention may be practiced in still other forms within the scope of the following claims.

What is claimed is:

1. An explosion-proof door structure for an opening in a metal wall comprising,

a door frame for bordering the wall opening on the outer side of the wall and having a frame flange extending outwardly from the wall,

a door comprising a rectangular first door pan of relatively thick sheet metal and having an outer door flange defining an inside corner and extending inwardly toward the wall in the closed position of the door, said door flange being receivable in surrounding relationship over said frame flange in the closed position of the door,

gasket means continuously extending along the inside corner of said first door pan, an element of said gasket means sealingly receiving the outer edge of said frame flange when the door is closed,

and a second door pan of relatively thin sheet metal extending from the inside bottom wall of said first door pan into the wall opening in the closed position of the door, said pan containing heat insulating material and being spaced by an element of said gasket means from face-to-face heat-transferring contact with the first door pan.

2. A vapor-proof door structure for an opening in a wall comprising,

a door frame for bordering the wall opening on the outer side thereof having an outwardly extending frame flange,

a door pivotally mounted on side of the door frame and including a first door pan of relatively thick sheet metal,

a flange on the door extending toward the wall in the closed position of the door and being placed in partially overlapping relation with said frame flange in such closed position,

gasket means extending continuously along the inside corner of the first door pan for sealingly receiving said frame flange,

and a second door pan of relatively thin sheet metal extending from the inside bottom wall of said first door pan into the wall opening in the closed position of the door.

3. An explosive-proof, vapor-tight door structure for an opening in a metal wall comprising,

a door frame for bordering the entire periphery of the wall opening on the outer side thereof having an outwardly extending frame flange,

a door hinged to and along one side of the door frame and including a first door pan of relatively thick sheet metal,

a flange adjacent the perimeter of the first door pan extending toward the wall in the closed position of the door and partially overlapping the frame flange on a side thereof remote from the wall opening,

gasket means extending continuously around the perimeter of the first door pan adjacent said flange for sealingly receiving said frame flange,

a second door pan of relatively thin sheet metal overlying and contacting said gasket means and secured to the inside of the first door pan through said gasket means, said second door pan extending into the wall opening in the closed position of the door,

and heat insulating material in the second door pan.

4. An explosive-proof, vapor-tight metal door structure, for an opening in a metal wall, adapted to withstand elevated temperatures without warping, said door structure comprising,

a metal door frame for bordering the entire periphery of the wall opening on the outer side thereof having an outwardly extending flame flange,

a door for outward opening away from the metal wall including opposed door pans,

a first door pan hinged with respect to the door frame of relatively thick sheet metal and having a U-shaped cross-section in both longitudinal and transverse axial directions and a relatively shallow depth,

a second door pan of relatively thin sheet metal having a U-shaped cross-section in both longitudinal and transverse axial directions and a relatively deep depth,

the leg portions of said U-shaped door pans being mounted with respect to each other in telescoping relation with the leg portions of the first door pan being exterior to those of the second door pan,

and gasket means interposed between the two door pans to isolate at least the second door pan from face-to-face heat-transferring contact with respect to the first door pan and to isolate at least the second door pan from the door frame.

5. The door structure of claim **4** wherein the first door pan telescopes as well the outerside of said frame flange, and said gasket means is carried adjacent the perimeter of the first door pan and by the leg portions thereof sealingly to receive also said frame flange.

6. The door structure of claim **4** wherein said second door pan contains heat insulating material between the leg portions thereof.

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