Nov. 7, 1933. A. MACCHI 1,934,438

EXPLOSION SAFETY DOOR FOR COMBUSTION CHAMBERS

Filed Aug. 14, 1931

Fig. 1.

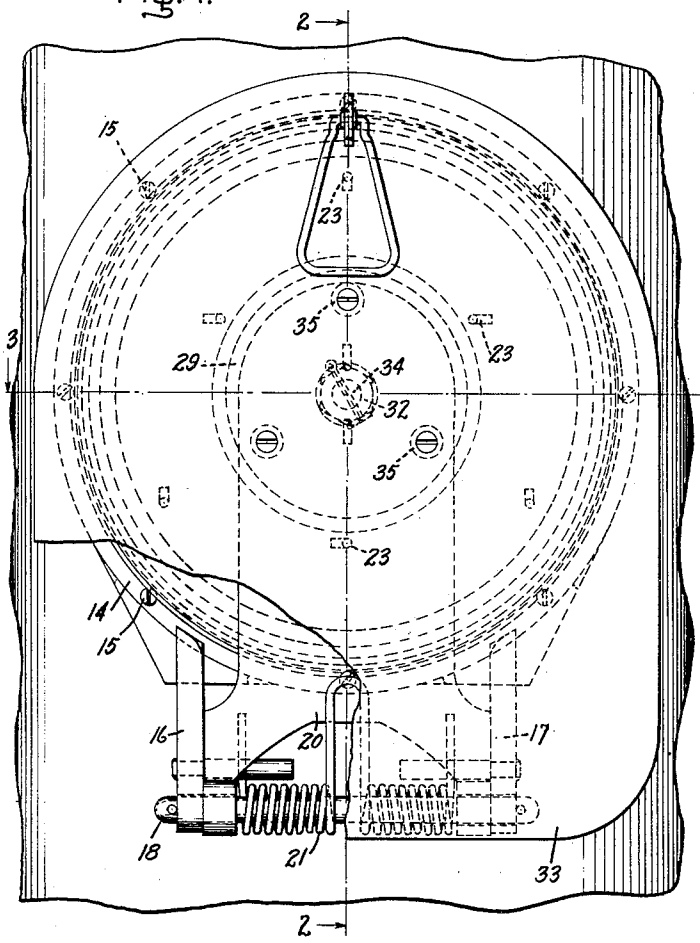


Fig 2.

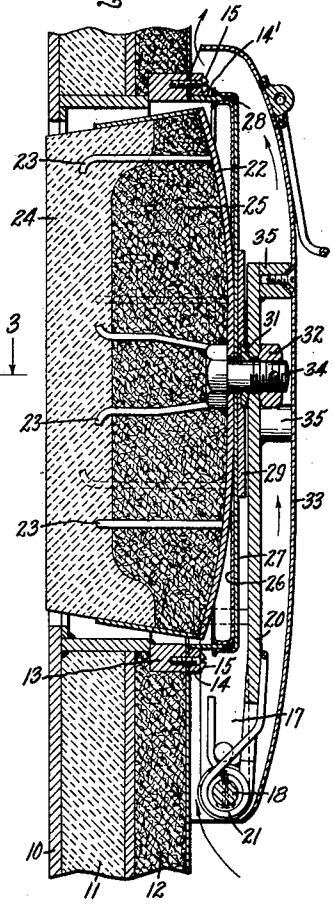
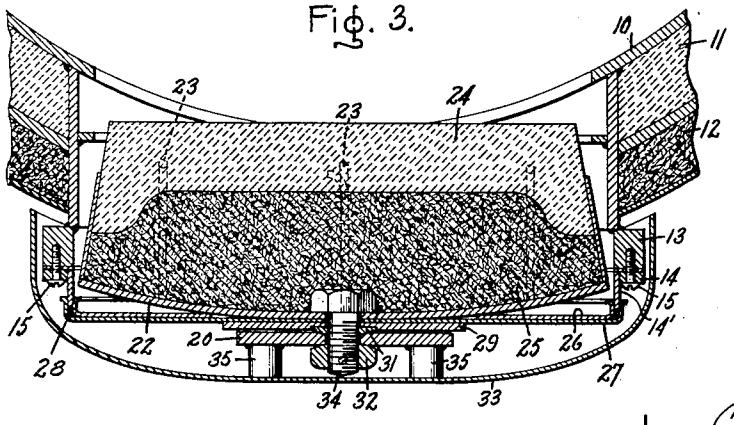


Fig. 3.



Inventor:
Aldo Macchi,
by Charles S. Mullan
His Attorney.

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EXPLOSION SAFETY DOOR FOR COMBUSTION CHAMBERS

Aldo Macchi, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

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8 Claims. (Cl. 110—173)

My invention relates to improvements in heating apparatus, more particularly to improvements in explosion safety doors for combustion chambers.

Oil burner furnaces are subject to occasional explosions within the combustion chamber, and therefore some means must be provided for permitting the explosion to spend itself without damaging the boiler, chimneys, or burner apparatus. This is usually provided for by means of an explosion safety door which is normally biased to a closed position and which on the occurrence of an explosion will respond to the increased pressure therein to open and thus relieve the pressure within the combustion chamber. It is necessary to provide a door which is light and can easily be opened and which is sturdy enough to withstand the shock of being suddenly opened and closed. Such a door must provide a gas-tight seal so that during the operation of the burner, air leakage will not affect the combustion within the combustion chamber. It is, of course, necessary to heat insulate the door and to reduce the transfer of heat from the interior of the combustion chamber to the outside of the door to a minimum. Means should be provided to carry away any heat which might find its way to the exterior of the door. Another desirable feature of such a door is the ability to make the door and frame as a unit to be fastened to the boiler.

Hence, it is an object of my invention to provide an explosion safety door and frame unit which is light and durable.

It is another object of my invention to provide an explosion safety door for a combustion chamber which provides an airtight seal.

A further object of my invention is to provide an explosion safety door for a combustion chamber which is self-cooled.

A still further object of my invention is to provide an explosion safety door for a combustion chamber which is heat-insulated and in which the heat-carrying sections are reduced to a minimum.

These and other objects will appear hereinafter.

Briefly, the preferred embodiment of my invention includes a door frame which can be fastened to the side of the combustion chamber. The frame is provided with a knife edge and has attached thereto a pair of arms for pivotally supporting a door biased to closed position. The bias permits the door to automatically open sufficiently to relieve the pressure within the combustion chamber if an explosion occurs therein and to close after the explosion is spent. The door comprises a portion consisting of a pair of concentric spun disks having a groove therebetween in which the knife edge of the frame is engaged when the door is in closed position. A heat-insulating portion carrying a member supported in spaced relation from these disks supports heat-insulating material by means of fingers within the frame but in spaced relation therewith. The member pivoted to the frame for supporting the door supports the door at its center by means of a bolt passing through the center of the door. The member is recessed at opposite sides so that a beveled washer and nut cooperating with the bolt carried by the door will center the door when the door is attached thereto. In this manner the door has contact with the frame only along the knife edge, thereby decreasing the heat-conducting surface contact between the door and the frame. Due to the fact that the heat-insulating material is supported in spaced relation with respect to the disks and the frame, practically no heat is transferred through the heat-insulating material to the outside of the door. Attached to the outside of the door is a cover carried in spaced relation to the door so that a natural draft of air passing between the door and the cover will carry away any heat which has found its way to the exterior of the door.

Referring to the drawing, Fig. 1 shows a front view of my door for a combustion chamber; Fig. 2 shows a cross section thereof along the line 2—2 of Fig. 1; Fig. 3 shows a cross section of the door along the line 3—3 of Fig. 1.

Referring specifically to the drawing in Fig. 1 and Fig. 2, the inner casing 10 of the combustion chamber is provided with a heat-insulating cover 11 and an outside insulating cover 12. Attached to the door opening in the side of the combustion chamber is the ring member 13. The door unit which is carried on the ring member 14 bolted to the ring 13 by suitable bolts 15 comprises the frame and the door. A pair of arms 16 and 17 welded to the ring 14 pivotally support upon the pin 18 extending therebetween the member 20 which supports the door and which is biased toward the frame by means of the spring 21. The frame is provided with the knife edge 14'.

The door is made up of several parts. A cup-shaped member 22 forms the inner part of the door and has welded thereto the fingers 23 which support the fire brick member 24 and the heat-insulating portion 25 comprising some light material such as asbestos to reduce the weight of the door.

Referring to Fig. 3, it will be seen that the door also comprises the two spun disk members 26 and 27 of different diameters which are concentrically mounted and provide between their edges or laterally extending flanges a groove which cooperates with the knife edge 14' of the door frame when the door is in closed position. A gasket 28 of heat-insulating material is provided in the groove to insure a tight joint which is leak-proof when the door is closed. A bolt member 34 carried by the cup portion 22 of the door extends outwardly and forms a support for the door upon the pivoted member 20. A washer 29 held in place by means of the beveled nut 31 clamps the disk members and the cup-shaped member together. The supporting member 20 is provided with an opening therethrough having recessed portions to engage the beveled nuts 31 and 32 which automatically centers the door when the door is fastened to the pivoted member 20. It will be noted that the door is mounted in spaced relation with the member 20. It will thus be seen that the conducting surfaces are very small since contact with the combustion chamber walls is found only at the knife edge of the door frame and contact with the inner portion of the door is found only in the bolt for supporting the door upon the pivoted member 20. Thus the heat transfer by conduction from the inner face of the door within the combustion chamber to the outside of the door formed by the disks 26 and 27 is reduced to a minimum.

To further insure that the door remain cool during combustion conditions within the combustion chamber, a cover 33 is supported upon the pivoted member 20 by means of the pillars 35 and the cooperating screws. It will be seen that this cover is mounted in spaced relation with respect to the door and that a natural draft will take place from top to bottom between the door and the cover. This natural draft of air will carry away any heat that has found its way to the outside of the door by conduction or radiation from the combustion chamber.

Thus it will be seen that I have provided a door and frame which can be mounted as a unit upon a combustion chamber. It will also be seen that my door is sturdy, light, provides a gas tight seal for the combustion chamber, is self-closing, self-cooled, and due to its unique construction reduces the heat conduction from the interior of the combustion chamber to the exterior of the door to a minimum.

In accordance with the provisions of the patent statutes I have described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A door unit for a combustion chamber including a door frame to be fastened to said combustion chamber, and a door for engaging said frame for forming a gas tight fitting when closed on said frame, a refractory supported by said door on the inside thereof at one point thereon in spaced relation with said door, and a cover for the outside of said door mounted in spaced relation therewith at a different point from the point of support for said refractory.

2. A door unit for a combustion chamber including a door frame to be fastened to said combustion chamber and provided with a knife edge and a door provided with a groove for cooperating with said knife edge for forming a gas tight joint therewith when in closed position, a refractory supported on the inside of said door in spaced relation with said door and centrally thereof at one point, and a cover for the outside of said door supported in spaced relation therewith at points spaced from the point of support for said refractory.

3. An explosion safety door unit for a combustion chamber including a door frame to be fastened to said combustion chamber and provided with a knife edge, a door supported by said frame, means for biasing said door to closed position, said door having a pair of concentric spun disks having laterally projecting flanges and forming a groove therebetween for said knife edge when said door is closed for providing a gas tight fitting between said door and said frame.

4. An explosion safety door unit for a combustion chamber including a circular door frame having a knife edge, a door supported by said frame having a pair of concentric spun disks of different diameters having laterally projecting flanges and forming a groove therebetween, said knife edge being engaged in said groove when said door is closed on said frame to provide a gas tight fitting between said door and said frame.

5. A self cooling door for a combustion chamber comprising a door frame, a door cooperating therewith a member movably mounted on said frame and supporting said door, a refractory having a supporting element joined to the door at one point for supporting the refractory in spaced relation with the door, a cover for the exterior of said door, said cover being supported by said movably mounted member in spaced relation with respect to said door at different points than the point of support for said refractory, whereby a draft between said door and cover will cool said door and cover.

6. A door for a combustion chamber including a door frame to be fastened to said combustion chamber, a heat insulated door cooperating with said frame and forming a gas tight fitting therewith when in closed position, a member movably mounted on said frame and supporting said door at one point and in spaced relation with said member elsewhere and on one side thereof and a cover for the exterior of said door carried by said member on the other side from said door in spaced relation with said member whereby a natural draft passing between said cover and door will maintain said cover and door cool during combustion within said combustion chamber.

7. An explosion safety door unit for a combustion chamber including a door frame to be fastened to said combustion chamber and provided with a knife edge, a pair of arms carried by said frame, a door having a groove for cooperating with said knife edge when said door is in closed position to form a gas tight joint, a member movably mounted between said arms, means for biasing said member toward said frame, said door being supported at its center by said biased member and provided with a spacer for spacing said door from said member, said center mounting causing the force of said bias to be evenly distributed between said knife edge and said door, whereby heat conduction

from said door to said member is reduced to a minimum.

8. An explosion safety door for a combustion chamber having a frame to be fastened to the combustion chamber, a door, a heat insulating material supported by said door in spaced relation therewith and extending through said frame and spaced therefrom when said door is in closed position, said door having a substantially line contact with said frame, said door including a member movably mounted on said frame for supporting said door at one point at its center whereby the heat transfer from the interior of the combustion chamber to the outside of said door is substantially reduced, and a cover carried by said member spaced from the outside of said door whereby a natural draft between said cover and said door will carry away any heat conducted to the exterior of the door from said combustion chamber.

ALDO MACCHI.