July 19, 1932. H. RACKEBRANDT 1,868,253

HEAT RESPONSIVE CLOSURE

Filed April 10, 1930

Fig. 1.

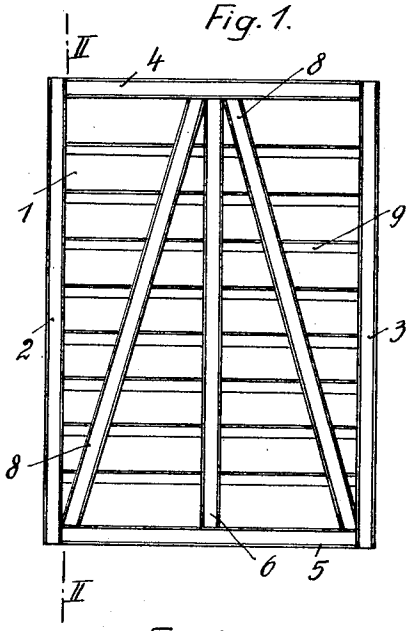


Fig. 2.

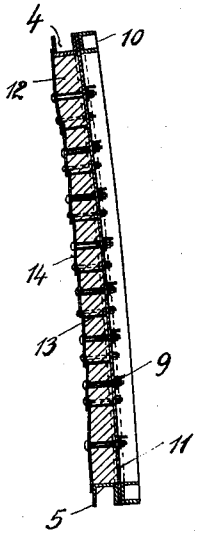


Fig. 3.

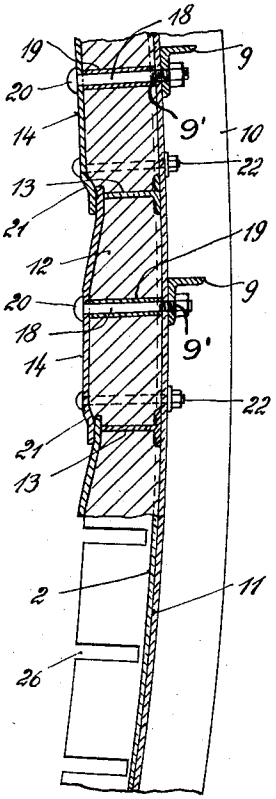


Fig. 5.

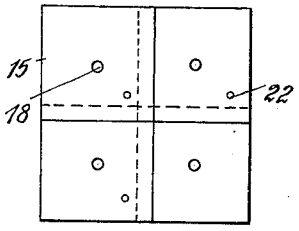


Fig. 6.

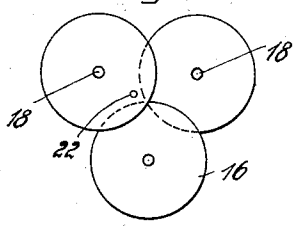


Fig. 7

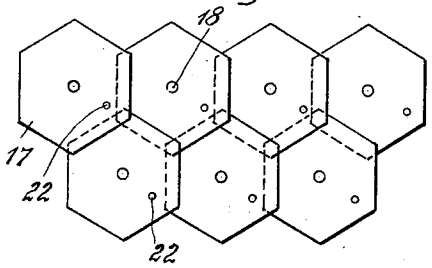
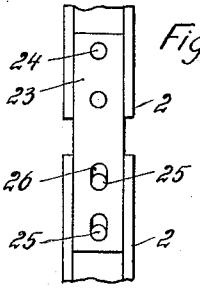


Fig. 4.



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UNITED STATES PATENT OFFICE

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HEAT-RESPONSIVE CLOSURE

Application filed April 10, 1930, Serial No. 443,176, and in Germany April 30, 1929.

My invention relates to closures such as doors, slides, gates and the like, and more particularly to closures which are subjected to different temperatures on their inner and outer faces. My heat-responsive closure is particularly designed for drying and other furnaces in which the temperature gradient between the combustion or drying chamber and the atmosphere is considerable.

It is an object of my invention to so design a closure of the kind described that it will become heat-responsive, that is, will be able to stand temperature gradients without being distorted, warped or otherwise deformed by heat-stresses.

To this end I build up the inner shell of the closure, that is, the shell which is subjected to the higher temperature, from a plurality of independent and overlapping plates so that the shell is free to expand without buckling of its plates, and secure each plate at its centre of gravity in order to ensure uniformity of expansion of the plates.

I may also, in combination with the built-up layer aforesaid, or independently of it, provide means permitting free expansion of the structure of the closure. For instance, in a structure or frame including several connected members like lattice work, I may provide expansion gaps of any suitable type, or, in a structure which includes sections, I may recess or notch a flange, or several flanges, of a section or sections so that the section or sections will not buckle under heat stress.

Closures of the kind described are made of sheet metal or steel structure, with or without insulating layers. As designed heretofore, such structures involve the serious drawback that they warp more or less under the influence of the elevated temperature, become leaky and admit cold air. In such cases troublesome and tedious operations are necessary for repacking the closure. Warping and other deformations are particularly inconvenient in large doors or the like which as a rule are designed as steel lattice work with an insulating layer. Those portions of the steel structure which face the interior of the furnace or the like are heated more intensely than the portions which are in heat exchange with the atmospheric air so that considerable stresses will occur and cause distortion of the structure. In closures of the slide or gate type warping has the additional inconvenience that it may cause the slides to jam in their guides so that they exert a considerable resistance against displacement, or become inoperative altogether.

These drawbacks are eliminated according to my invention in which the inner layer of the closure is free to expand due to its built-up construction while the structure itself may be provided with gaps or notched sections for heat-expansion.

In the drawing affixed to this specification and forming part thereof a frame of lattice work embodying my invention, and some of its details, are illustrated diagrammatically by way of example.

In the drawing—

Fig. 1 is an elevation of a frame which is built up from channel and angular sections, viewed from the outside of the chamber which it is designed to close,

Fig. 2 is a section on the line II—II in Fig. 1,

Fig. 3 is partly a section showing a portion of a slightly modified frame, and partly an elevation of one of its bars showing the notched flange of the bar section,

Fig. 4 is a detail showing an expansion gap in a member of the frame, and

Figs. 5, 6 and 7 illustrate various types of overlapping plates for the inner shell.

Referring now to the drawing, and first to Figs. 1 and 2, 1 is a rectangular frame or structure which is built up from two longitudinals 2 and 3, transverse bars 4 and 5 at the upper and lower ends of the longitudinals 2 and 3, a central strut 6, diagonal 8, all of channel section, and angle sections 9 extending in parallel to the transverse bars 4 and 5. 10 is a frame which is secured on the outer face of the frame 1, and 11 is an unbroken shell of sheet metal which is inserted between the outer frame 10 and the members of the main frame 1.

Instead of channel and angle sections as shown, any other type of sections might be provided.

12 is an insulating layer which is provided on the inner face of the shell 11 and may be subdivided into several sections by means of partitions 13 which as illustrated are T-sections riveted or otherwise secured to the inner face of the shell 11. The inner shell 14 is built up from a plurality of plates which overlap each other as shown for rectangular plates 15 in Fig. 5, for circular plates 16 in Fig. 6, and for hexagonal plates 17 in Fig. 7. Each plate is supported by a detachable bolt 18, preferably at its centre of gravity. The bolts 18 are inserted in holes 9′ of the vertical flanges of the sections 9, extend through the insulating layer 12 from which they are separated by hollow cylinders 19, and support the plates of the inner shell 14 by their heads 20. The overlaps are constituted by a bevelled portion 21 at the edge of one plate, and a straight portion at the mating edge of the other plate, as best seen in Fig. 3.

In addition to the bolts 18 which are arranged at the centre of gravity of the respective plates, a bolt 22 is provided for each plate outside its centre of gravity for preventing lifting of the plates. The bolts 22 are down holders only and will not interfere with the uniform expansion of the plates because they are not braced by cylinders 19, like the bolts 18, and also are thinner than the bolts 18 so that they may yield transversely in conformity with the expansion and contraction of the plates.

Referring now to Fig. 4, one of the members of the frame 1 which have been shown undivided in Fig. 1, for instance, the longitudinal 2, is divided, and the ends of its parts are spaced apart. 23 is a fish-plate which is secured to the web of one of the parts by rivets or the like 24, and 25 are bolts or the like on the other part of the bar which enter extended slots 26 in the fish-plate 23.

Instead of dividing the members as illustrated, their flanges may be recessed or notched as shown at 26 for the longitudinal 2 in Fig. 3, so that when heat-expansion occurs, the flanges will not buckle under the stress.

Direct action of the heat on the outer shell 11 and the parts which are connected with it, is prevented by the insulating layer 12, while those parts which are subjected to direct action of the heat are so designed, that they are free to expand substantially without stress. This problem may be solved in various ways as described.

I wish it to be understood that I do not desire to be limited ot the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

In the claims affixed to this specification no selection of any particular modification of the invention is intended to the exclusion of other modifications thereof and the right to subsequently make claim to any modification not covered by these claims is expressly reserved.

I claim:—

1. A heat-responsive closure for structures in which the temperatures at the inner and outer faces of the closure are different, comprising a frame, a shell on said frame which is built up from over-lapping plates, and means for securing each plate to said frame at its centre of gravity.

2. A heat-responsive closure for structures in which the temperatures at the inner and outer faces of the closure are different, comprising a frame, a shell on said frame which is built up from over-lapping plates, means for securing each plate to said frame at its center of gravity, and means secured outside said centres of gravity for holding down said plates.

3. A heat-responsive closure for structures in which the temperatures at the inner and outer faces of the closure are different, comprising a frame, an outer shell on said frame, an insulating layer on said shell on the side exposed to the higher temperature, a shell built up of over-lapping plates on the face of said insulating layer, and bolts extending through said insulating layer and said shells for securing said plates at their centres of gravity.

4. A heat-responsive closure for structures in which the temperatures at the inner and outer faces of the closure are different, comprising a frame, an outer shell on said frame, an insulating layer on said shell on the side exposed to the higher temperature, a shell built up of over-lapping plates on the face of said insulating layer, bolts extending through said insulating layer and said shells for securing said plates at their centres of gravity, and bolts also extending through said shells and engaging said plates at points outside said centres of gravity.

5. A heat-responsive closure for structures in which the temperatures at the inner and outer faces of the closure are different, comprising a frame, an outer shell on said frame, an insulating layer on said shell on the side exposed to the higher temperature, a shell built up of over-lapping plates with one of their over-lapping edges beveled on the face of said insulating layer, and bolts extending through said insulating layer and said shells for securing said plates at their centres of gravity.

6. A heat-responsive closure for structures in which the temperature at the inner and outer faces of the closure are different, comprising a frame, means in said frame for permitting heat expansion, a shell on said frame which is built up from over-lapping plates, and means for securing each plate to said frame at its centre of gravity.

7. A heat-responsive closure for structures in which the temperatures at the inner and outer faces of the closure are different, comprising a frame consisting partly of flanged members, a notched flange on one of said members, a shell on said frame which is built up from over-lapping plates, and means for securing each plate to said frame at its centre of gravity.

In testimony whereof I affix my signature.

HEINRICH RACKEBRANDT.