Feb. 5, 1935. G. E. HOWARD 1,989,985

SUPPORTING MEANS FOR FURNACE STRUCTURES

Filed Jan. 14, 1933

Fig. 1.

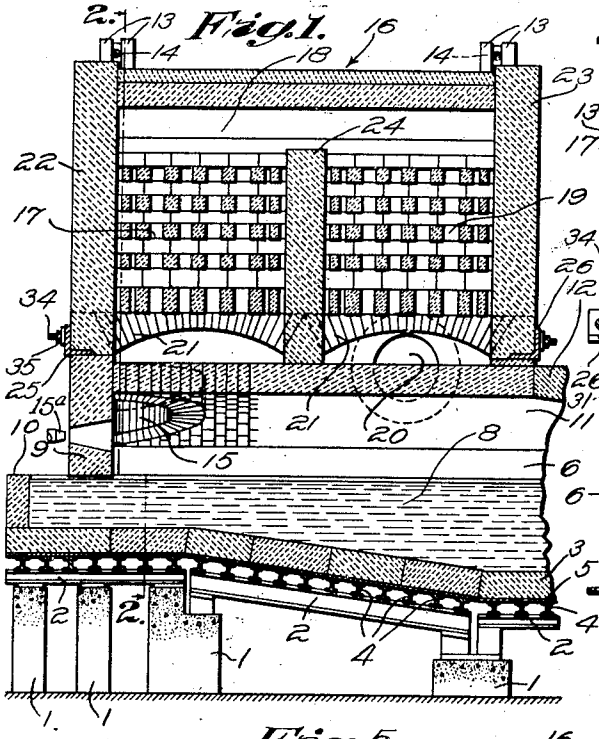


Fig. 2.

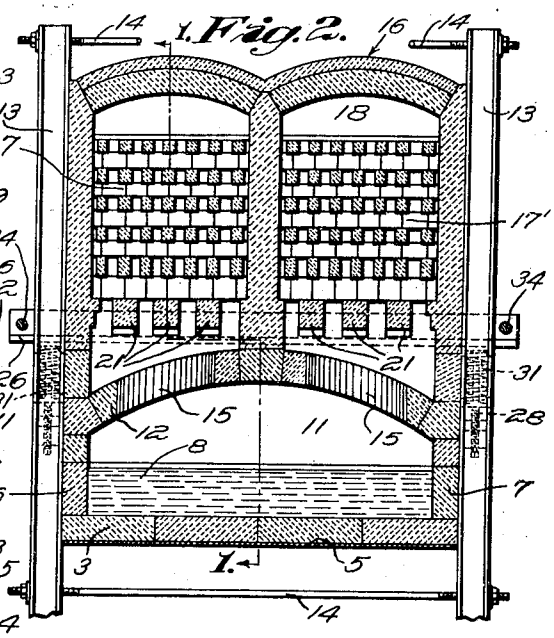


Fig. 5.

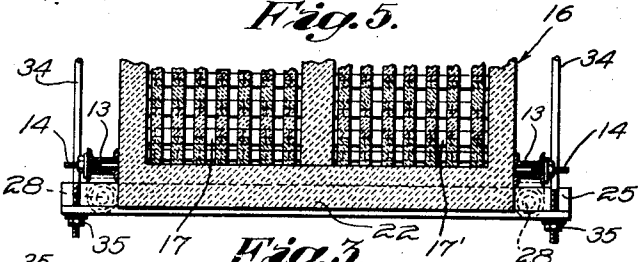


Fig. 4.

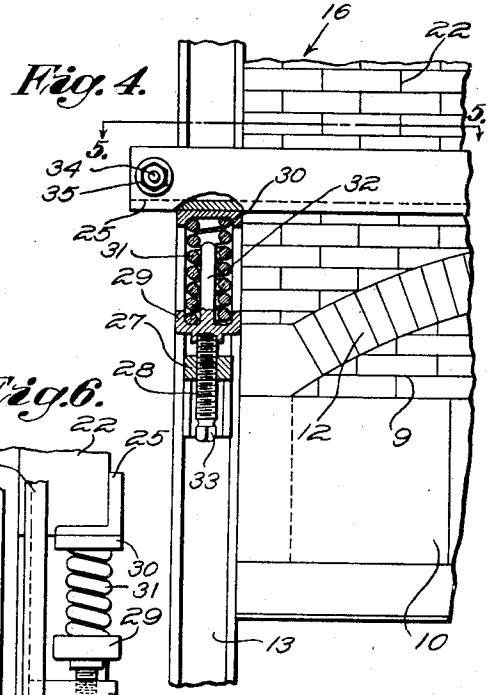


Fig. 3.

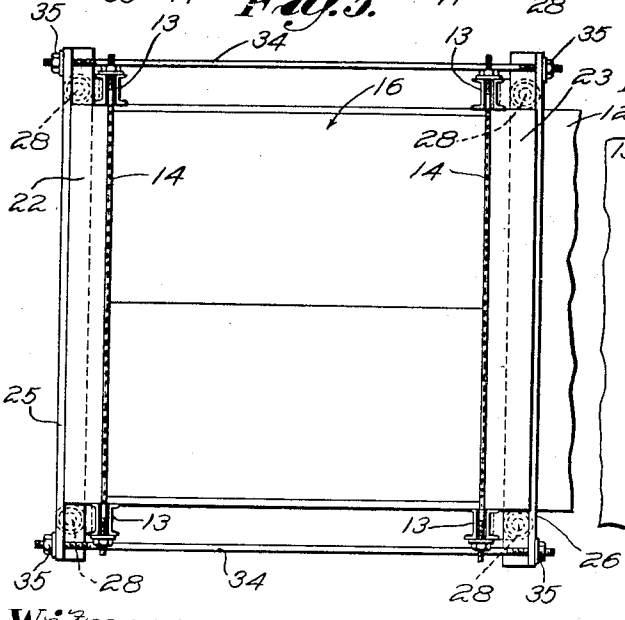
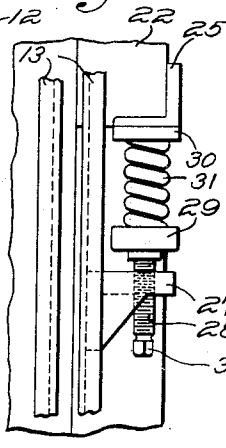


Fig. 6.



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UNITED STATES PATENT OFFICE

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SUPPORTING MEANS FOR FURNACE STRUCTURES

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Application January 14, 1933, Serial No. 651,723

8 Claims. (Cl. 263—15)

This invention relates to means for supporting furnace structures, particularly structures built above the crown or arch of a furnace wherein high temperature operations are to take place. More specifically the invention relates to means for the support of superimposed walls and/or structures disposed above the crown of the furnace, the temperature of which is such that it is desirable to reduce the vertical load upon the crown in order to avoid deformation thereof and of other portions of the furnace.

It has previously been suggested to build over the crown of a furnace for high temperature operation, such for example as a glass melting furnace, certain structures which may be used for enclosing flues, checkers, etc., such for example as a regenerator or a recuperator, and which it is desired to maintain as nearly air tight as possible. Such designs involve in their practical construction questions of support for the superimposed structures inasmuch as all such structures of the character described involve a considerable weight load which must be supported in some manner. If some such structure were supported directly upon the roof arch of a high temperature furnace, there would be grave danger of a failure or at least of a deformation of the arch and/or the side walls of the furnace particularly when the furnace was heated to high temperature as the mechanical strength of the materials used at such temperatures is greatly reduced, and also there is a certain degree of expansion of the furnace materials incident to their rise in temperature which must be accommodated. It is desirable, therefore, that some independent means of support be provided for such superimposed structure. The most obvious answer to this problem would apparently be to support the superimposed structure directly from some structural metal frame work, for example the buck stays normally used in furnace construction, so as to take all the load of the superimposed structure off the furnace arch and walls. Here again, however, difficulties would be met with due to the fact that if a furnace were constructed in this manner, the differential expansion of the parts might and probably would cause the opening of substantially horizontal cracks or joints which would result in leakage into or out of the superimposed structure which it is desired to keep air tight or as nearly air tight as possible.

Among the objects of the present invention, therefore, are to provide suitable means for adequately supporting such a superimposed structure as has been suggested above without incurring the liability of leakage incident to the differential expansion of the parts.

A further and more specific object of the present invention is to provide a means by which a superimposed structure of the character described may be partially supported from the external and relatively cool structural metal frame work, such as the buck stays normally used, and in which the remainder of the vertical load of the superimposed structure is sustained by the usual arch and walls of the furnace, so that this remaining load may serve to prevent the opening of substantially horizontal joints or cracks through which leakage might occur.

A further specific object of the present invention is to provide means of the character described wherein a variable proportion of the vertical load of the superimposed structure may be supported directly from the externally relatively cool structural metal frame work, such as the buck stays.

A further specific object of the present invention is to provide means for the support of a portion of the vertical load of the superimposed structure including the interposition of resilient means between the members which are in direct supporting relation to the superimposed structure and the external rigid structure, such as the buck stays.

Other and more specific objects of the present invention will become apparent from a reading of the following specification and appended claims when taken in connection with the accompanying drawing, in which:

Figure 1 is a fragmentary view in vertical longitudinal section substantially on the line 1—1 of Fig. 2, showing the charging end of a glass melting furnace and a superimposed regenerator above the crown thereof;

Fig. 2 is a view in vertical transverse section substantially on the line 2—2 of Fig. 1;

Fig. 3 is a view in plan of the portion of the furnace shown in Fig. 1;

Fig. 4 is a fragmentary view in end elevation illustrating a means for supporting the superimposed structure according to the present invention, certain parts being broken away and in vertical section to show the construction thereof;

Fig. 5 is a fragmentary view in horizontal section on the line 5—5 of Fig. 4; and

Fig. 6 is a fragmentary view in elevation showing a portion of the supporting means of my present invention as seen from the left of Fig. 4.

While the present invention is applicable to any furnace wherein there is a superimposed struc-

ture disposed above the crown thereof and which it is desired independently to support, I have chosen to illustrate my invention as applied to a furnace for melting glass which may be substantially the type of the furnace shown in my copending application, Serial No. 651,964 filed Jan. 16, 1933.

The furnace illustrated in the accompanying drawing is supported upon a plurality of masonry piers 1 which directly support substantially longitudinally extending structural metal members 2 which support the bottom 3 of the furnace through transversely extending structural metal members 4, there being if desired metallic strips or a metal plate indicated at 5 disposed intermediate the members 4 and the bottom 3 of the furnace.

The furnace comprises a glass containing basin including the bottom 3, side walls 6 and 7 and suitable end walls for containing a bath of molten glass 8. At the left hand end, as seen in Fig. 1, the glass containing basin is extended as at 10 beyond the depending end wall 9 to form an inlet opening for the glass making materials to be melted and converted into glass, this extension being known in the art as a "doghouse". The portion of the furnace to the right of that part shown in Fig. 1 may be constructed in any desired or conventional manner. Inasmuch as this portion of the furnace forms no part of the present invention, it is not illustrated and will not be further described. Above and defining the top of the flame space 11 in the furnace is the usual roof arch 12. Lateral support is provided for the furnace by means of the usual buck stays indicated at 13, these buck stays being tied together above and below the furnace proper by the usual tie rods 14. Thus far the furnace which has been described may be assumed to be entirely conventional for the purpose of the present description.

Means are provided for supplying the necessary heat to the flame space 11 of the furnace, in the present instance for supplying heat to melt the glass making materials supplied thereto through the dog house 10 and for refining the glass, in a manner which may be considered as well known in the art. This heat is supplied by the burning of fuel introduced through suitable burners as at 15a (Fig. 1), the products of combustion passing from the furnace through ports, one of which is indicated at 15, Fig. 1. The products of combustion then pass through a regenerator structure generally indicated at 16. This structure comprises similar pairs of regenerators each of which includes a block of checkers, as the checkers 17, a horizontal pass or chamber 18 at the top and a block of checkers, as the checkers 19 through which the products of combustion may pass in sequence to an outlet passage, generally indicated at 20 (Fig. 1). It will be understood that air passes in through one of the pair of regenerators while the products of combustion pass out through the other of the pair, and that reversals are periodically effected by any suitable means (not shown) as by means now used in regenerative furnaces in the art. The pairs of regenerators are illustrated in Fig. 2 wherein the checker blocks 17 and 17' are shown, one belonging to each pair, as will be seen by a comparison of Figs. 1, 2 and 3. As shown in Figs. 1 and 2, the regenerator checkers in the several checker chambers are supported upon arches 21 suitably sprung between the end walls 22 and 23 of the regenerator and an intermediate wall 24. The particular construction of the regenerators illustrated in the accompanying drawing is, however, unessential to the present invention, the only essential being that there be some superimposed structure disposed above the arch 12 or a portion thereof and which it is desired to support in a suitable manner so as to relieve preferably a major part of the vertical weight load of the superimposed structure from side walls 6 and 7, the end wall 9 and the crown 12, and wherein it is desired to prevent or at least to minimize leakage into or out of the superimposed structure.

The superimposed structure here shown as comprising the regenerator structure 16 is provided with suitable structural metal members in supporting relation thereto. As shown, the walls 22 and 23 have in supporting relation thereto angle bars 25 and 26 respectively which are adapted to afford support for these walls and for the superimposed structure as an entirety. Should these angle bars 25 and 26 be fixedly connected to the buck stays 13, the situation might arise, especially during the heating up of the furnace, wherein the differential expansion of various portions thereof would open a substantially horizontal joint, as the joint beneath these angle bars, which would cause leakage into or out of the regenerator structure 16. In order to avoid this difficulty, therefore, it is desired only partially to support the superimposed structure comprising the regenerator 16 through the direct support of the angle bars 25 and 26 from the buck stays. For this purpose the buck stays are provided with brackets 27 suitably secured thereto, through which brackets extend the threaded stems or studs 28 which may be integral with or arranged suitably to support the lower spring bearing cups 29. Extending between the lower spring bearing cups 29 and upper spring bearing cups 30 are heavy compression springs 31, the cups 30 being suitably disposed under and, if desired, secured to the angle bars 25 and 26 adjacent to their ends, as illustrated in the drawing. The lower spring bearing cups 29 may be provided with upwardly extending stems 32 concentric with the springs 31 so as to prevent lateral distortion of the springs. Thus a desired proportion of the vertical weight load carried by the angle bars 25 and 26 may be transmitted directly to the buck stays 13 through the spring bearing cups 30, the springs 31, the spring bearing cups 29, the threaded studs 28 and the brackets 27. The proportion of the vertical load thus carried may be varied as desired by varying the compression of the springs 31, which may be accomplished by the application of a suitable tool to the squared lower ends 33 of the threaded studs 28 to screw these studs up or down with respect to the brackets 27. The angle bars 25 and 26 are suitably connected together by tie rods 34 provided with nuts 35 at their outer ends bearing against these angle bars, so that the angle bars are prevented from lateral dislodgment while permitting suitable adjustments to be made to accommodate any lateral expansion which may take place as during the initial heating of the furnace.

Thus by the construction above described, I have provided for the support of a selected portion of the vertical weight load of the superimposed structure directly from the external relative cool supporting structure comprising the buck stays 13 by the intermediation of adjustable

means comprising the springs 31 and the adjustable threaded studs 28 for thereby relieving a desired proportion of the vertical load of the superimposed structure from the roof arch 12 of the furnace, the side walls 6 and 7 and the end wall 9, while permitting the remainder of the vertical load of the superimposed structure to be effective through the compression of the springs 31 to retain substantially air tight the superimposed structure comprising, in the present instance, the regenerator 16.

While I have shown and described but one form of my invention, it will be obvious that modifications may be made therein without departing from the spirit thereof. I do not wish to be limited, therefore, except by the scope of the appended claims which are to be construed as broadly as the state of the prior art permits.

I claim:

1. Furnace structure for high temperature operation, including substantially vertical walls and a crown, substantially rigid supporting means adjacent to said vertical walls, a superstructure on said crown, and means between said rigid supporting means and said superstructure for relieving the crown of a predetermined portion less than the whole of the weight load of said superstructure while permitting said furnace structure and said superstructure to expand and contract substantially as a unit, the remainder of the weight load of said superstructure being carried by said walls and crown.

2. Furnace structure for high temperature operation, including substantially vertical walls and a crown, external, substantially rigid supporting means adjacent to said vertical walls and maintained relatively cool during furnace operation, a superstructure on said crown, resilient means interposed between said rigid supporting means and said superstructure for relieving the crown of a predetermined variable proportion of the weight load of said superstructure while permitting said furnace structure and said superstructure to expand and contract substantially as a unit, and means for manually adjustably varying the proportion of the weight load of said superstructure supported by said rigid supporting means.

3. Furnace construction for high temperature operation, comprising wall structures laterally defining a flame space for the furnace, an arched crown defining the upper limit of said flame space, buckstays for affording lateral support for said wall structures and for said arched crown, a superimposed structure disposed above the arched crown of the furnace, structural metal members arranged in supporting relation to said superimposed structure, and means interposed between said structural metal members and certain at least of said buckstays for supporting a part of the vertical load of said superimposed structure directly from said buckstays, whereby partially to relieve the stress on said arched crown and said wall structures due to the vertical weight load of said superimposed structure.

4. Furnace construction for high temperature operation, comprising wall structures laterally defining a flame space for the furnace, an arched crown defining the upper limit of said flame space, buck stays for affording lateral support for said wall structures and for said arched crown, heat recovery structure for the transfer of a part of the heat of the outgoing products of combustion from the furnace to preheat the incoming air disposed above at least a portion of said arched crown, structural metal members arranged in supporting relation to said heat recovery structure, and means interposed between said structural metal members and certain at least of said buck stays for supporting a part of the vertical weight load of the superimposed heat recovery structure directly from said buck stays to relieve a portion of the stress on said arched crown and wall structures due to the vertical weight load of the superimposed heat recovery structure.

5. Furnace construction for high temperature operation, comprising wall structures laterally defining a flame space for the furnace, an arched crown defining the upper limit of said flame space, buck stays for affording lateral support for said wall structures and for said arched crown, a superimposed structure disposed above at least a part of the arched crown of the furnace, structural metal members arranged in supporting relation to said superimposed structure, means interposed between said structural metal members and certain at least of said buck stays for supporting a part of the vertical weight load of said superimposed structure directly from said buck-stays, and means for adjustably varying the proportion of the weight load of said superimposed structure supported directly by said buck stays through the last named means, whereby partially to relieve the stress on said arched crown and said wall structures due to the vertical weight load of said superimposed structure while leaving a desired proportion of said vertical load supported directly by said arched crown and said wall structures for preventing separation of the several parts of the furnace and consequent leakage incident to the differental expansion of the several independently supported sections thereof.

6. Furnace structure for high temperature operation, comprising wall structures laterally defining a flame space for the furnace, an arched crown defining the upper limit of said flame space, buck stays for affording lateral support for said wall structures and for said arched crown, a superimposed structure disposed above at least a part of the arched crown of the furnace, structural metal members arranged in supporting relation to said superimposed structure, and resilient means interposed between said structural metal members and certain at least of said buck stays for resiliently supporting a part of the vertical weight load of said superimposed structure directly from said buck stays, whereby partially to relieve the stress on said arched crown and said wall structures due to the vertical weight load of said superimposed structure while permitting relative expansive movement of the several portions of the furnace and at the same time preventing separation of such furnace portions due to the relative expansive movement thereof and consequent leakage.

7. Furnace construction for high temperature operation, comprising wall structures laterally defining a flame space for the furnace, an arched crown defining the upper limit of said flame space, buck stays for affording lateral support for said wall structures and for said arched crown, a regenerator structure disposed above at least a part of the arched crown of the furnace, structural metal members arranged in supporting relation to the superimposed regenerator structure, and compression springs interposed between said structural metal members and certain at least of said buckstays for supporting a part of the ver-

tical weight load of said superimposed regenerator structure directly from said buck stays, whereby partially to relieve the stress on said arched crown and said wall structure due to the vertical weight load of said regenerator structure while permitting relative expansive movement of the several portions of the furnace and regenerator structure and preventing separation thereof due to said relative expansive movement which might cause leakage into or out of the regenerator structure.

8. Furnace construction for the making of glass, comprising a glass containing basin, a flame space thereabove defined by lateral walls and an arched crown, buck stays for affording lateral support to said lateral walls and to said arched crown, a regenerator structure forming a part of the heating system for the furnace and disposed above at least a part of the arched crown of the furnace, structural metal members arranged in supporting relation to said regenerator structure, compression springs interposed between said structural metal members and certain at least of said buck-stays for supporting a part of the vertical weight load of said regenerator structure directly from said buck stays, and means for adjustably determining the compression of said springs, whereby to relieve to a desired extent the stress on said arched crown and the walls of said furnace due to the vertical weight load of the superimposed regenerator structure while permitting relative expansive movement of the parts of the furnace and of the regenerator structure and at the same time preventing separation of the portions of the furnace and of the regenerator structure due to such relative expansive movement so as to prevent leakage into or out of the furnace and the regenerator structure.

GEORGE E. HOWARD.