June 5, 1934. C. F. RYAN 1,961,510

FURNACE AND REGENERATOR CONSTRUCTION THEREFOR

Filed Jan. 5, 1933

Fig. 1.

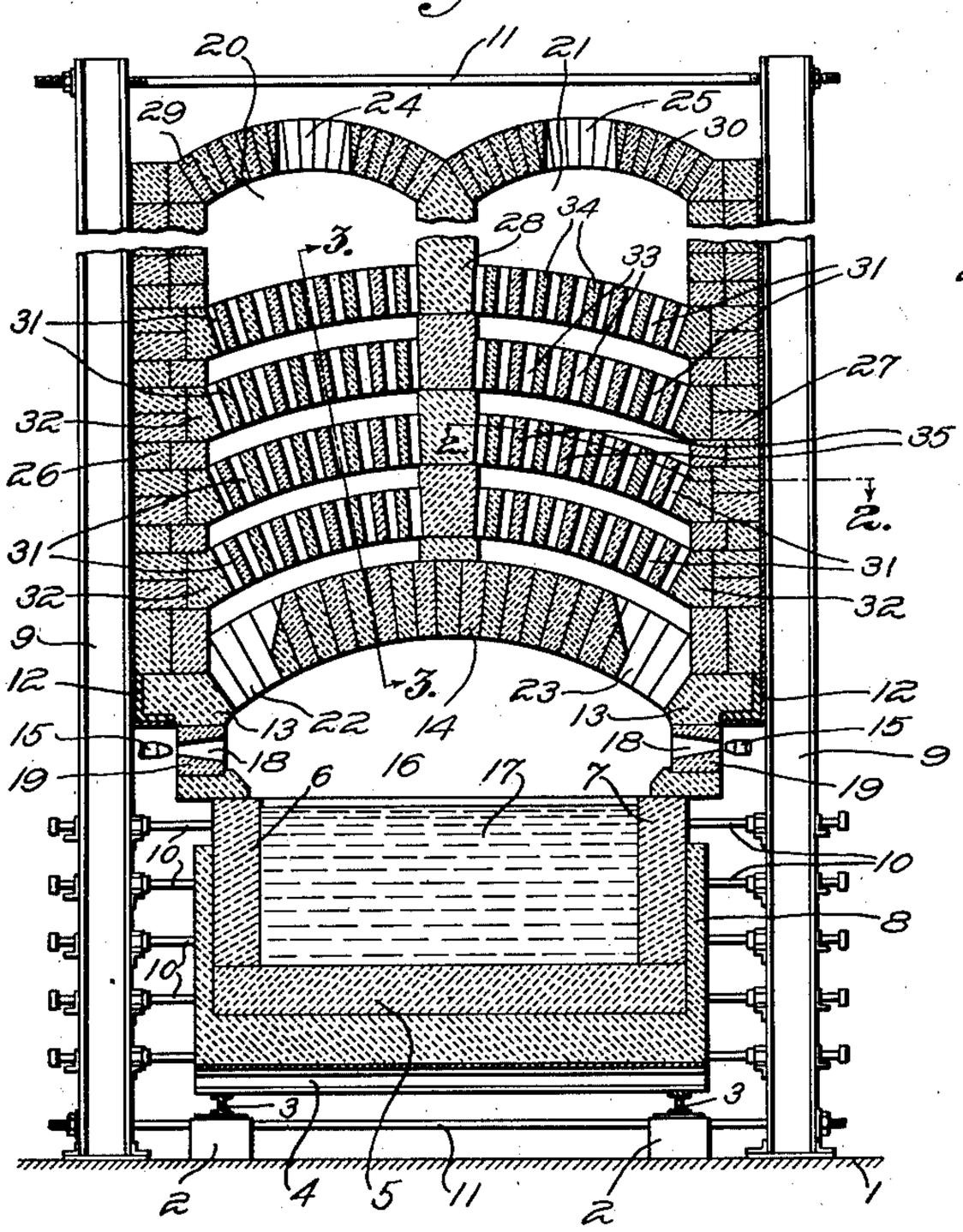


Fig. 2.

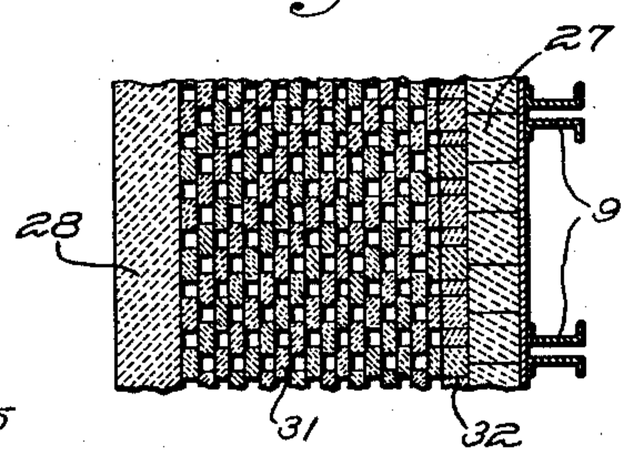
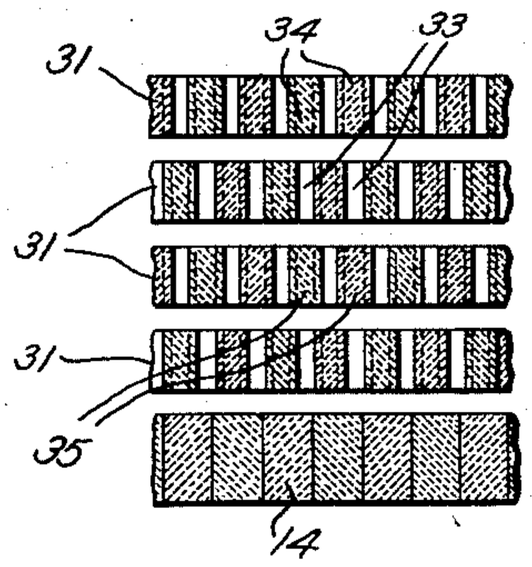


Fig. 3.



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FURNACE AND REGENERATOR CONSTRUCTION THEREFOR

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7 Claims. (Cl. 263—15)

This invention relates to regenerator furnaces for high temperature work and also to regenerator constructions for use with furnaces of this type. More particularly the invention relates to that type of regenerator furnace in which the regenerators are constructed in whole, or in part, above at least a portion of the roof arch of the furnace.

Among the objects of the invention is to provide a regenerator including a plurality of courses of checker bricks, each course of which is built in the form of an arch so that each course may be supported independently of the other courses.

A further object of the invention is to provide a regenerator particularly, though not necessarily, for use above the roof arch of a furnace wherein the checker brick are in the form of arches, or part arches, and wherein the arches or part arches have spaces therebetween, and in which the arches are struck on the arcs of circles all having a common center. This construction is particularly useful in a top regenerator furnace inasmuch as the arrangement of the arches, all struck about a common center, provides for spaces of uniform width between the several arches of checker bricks and the use of the arch-like arrangement for the bricks provides for the support of the weight load of the checker bricks from the lateral walls, which may be externally supported as by the usual buck stays.

Other and more detailed 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 view in vertical transverse section of a furnace for making glass embodying my invention, including regenerators built above at least a part of the arched crown thereof;

Fig. 2 is a fragmentary view in section on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary view in section on the line 3—3 of Fig. 1.

Referring to the form of the invention shown in Figs. 1 to 3 inclusive, there is illustrated a furnace for melting glass in conjunction with which my invention has been incorporated. As shown, the furnace is supported upon a suitable floor or base 1 on which are mounted a plurality of piers 2 which may be of masonry. These piers carry substantially longitudinally extending I-beams 3 which support transverse beams 4, which in turn carry the weight load of the glass-containing basin of the furnace. This basin is formed with a bottom 5 and side walls 6 and 7. Outside the bottom and walls of the glass-containing basin there is illustrated a layer 8 of heat insulating material which may be provided if desired. The usual buck stays 9 are provided for affording lateral support to the glass containing basin of the furnace and also for supporting other portions thereof, hereinafter to be described. The lateral walls of the glass containing basin are supported from the buck stays through compression members 10. The buck stays may be fastened together in the usual manner by the tie rods 11 adjacent to their upper and lower ends. The buck stays 9 are adapted directly to support longitudinally extending angle members 12 which may be secured thereto in any desired manner, these angle members supporting skew blocks 13 between which the roof arch 14 is sprung.

Means are provided for supplying heat to the furnace for carrying on the desired operations, in this instance in melting glass making materials and refining the glass. As shown in the accompanying drawing, such means include burners 15 which are adapted to direct fuel into the flame space 16 above the bath of molten glass 17 in the furnace through burner openings 18. These burner openings are as shown formed in suitable burner blocks 19 which may be set into suitable apertures in the skew blocks 13, or may be disposed thereunder. The particular construction of the portions of the furnace thus far described form, however, no necessary part of the present invention.

As shown in Fig. 1, a pair of regenerators 20 and 21 are disposed above at least a portion of the roof arch 14 of the furnace and communicate with the flame space 16 through ports 22 and 23 respectively. Outlet ports 24 and 25 are provided for the pair of regenerators 20 and 21 respectively and may communicate with a suitable stack and a source of air in any usual or desired manner through any suitable reversing valve mechanism (not shown). The regenerators 20 and 21 are built up within enclosing walls, including side walls 26 and 27 which are supported by the angle members 12 directly from the buck stays 9. The regenerators are divided by an intermediate wall 28 which is built up above the roof arch at the highest portion thereof and which extends substantially parallel to this arch along the high part above the keystones of the arch. The regenerator chambers are closed at the top by arches 29 and 30 respectively.

Instead of disposing the checker bricks in the regenerators in the usual manner, I prefer to arrange these bricks in a plurality of half arches

as shown, each half arch in one regenerator being opposite a similar half arch in the other, so that the two half arches, together with a portion of the intermediate wall 28, form a complete arch sprung between suitable skew blocks built into the side walls 26 and 27. In this way I am enabled to support substantially all the weight of the checker bricks directly from the side walls which are supported directly from the buck stays 9 through the structural angles 12 as above set forth. The disposition of the checker bricks in each arch is best seen by a comparison of Figs. 1, 2 and 3 and provides for a plurality of spaces or gas passages between the bricks through which the products of combustion may pass upwardly or the air pass downwardly in passing through the regenerators. I have shown only a portion of the regenerator including four arches 31 of checker bricks supported in this manner between skew blocks 32, which are built into side walls 26 and 27. The center wall 28 may be considered as built of the keystones of the several arches of checker bricks, so that substantially the whole weight of this wall may be supported from the side walls 26 and 27. I preferably arrange the several arches 31 on the arcs of circles, all of which have a common center, this center being the same as that of the roof arch 14. Thus the spaces between the several arches 31 will be uniform in height from the side to the center.

Furthermore, it is desirable in regenerator construction that there be as high a heat transfer coefficient as possible between the gases passing through the regenerator and the checker bricks, so as to have the maximum heat transfer for a given regenerator. This may be achieved to a great extent by providing tortuous passages for the gases through the regenerator, which will porvide a high degree of turbulence to the gases and thus cause an increase in the heat transfer coefficient. As shown, the openings through any one arch portion are respectively opposite checker bricks in the adjacent arch portions both above and below, and are out of alignment with the openings in such adjacent arch portions. For example the openings 33 seen in Figs. 1 and 3 will be respectively opposite checker bricks 34 in the arch portion immediately above and respectively opposite checker bricks 35 in the arch portion immediately below.

I have designed a regenerator construction in which there will necessarily be a high degree of turbulence of the gases passing therethrough due to the peculiar and novel arrangement of the checker bricks, and I have further provided for the independent support of each of the several courses of checker bricks in the regenerator by forming each of these courses as an arch or arch portion.

It is obvious that many changes may be made in the above disclosed embodiments of my invention 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. A regenerator, comprising a plurality of courses of checker bricks, each course being supported independently of the others, the checker bricks being so disposed and arranged in the several courses that the openings between the checker bricks of any one course are in alignment with checker bricks of the adjacent courses in each direction and out of alignment with the openings between the checker bricks of such adjacent courses.

2. A regenerator, comprising a plurality of vertically spaced courses of checker bricks, each course being formed as at least a part of an arch and being supported as an arch independently of the other courses, the checker bricks being so disposed and arranged in each of the several courses that the openings between the checker bricks in any one course are in alignment with checker bricks of the adjacent courses above and below the one in question and out of alignment with the openings between the checker bricks of such adjacent courses.

3. A regenerator, comprising a plurality of courses of checker bricks so constructed and arranged as to provide for the passage of gaseous media through the courses between the top and bottom of the regenerator, each course being formed as at least a part of an arch and being supported as an arch independently of the other courses.

4. A regenerator, comprising a plurality of vertically spaced courses of checker bricks, each course being formed as at least a part of an arch and being supported as an arch independently of the other courses, all the arched courses of bricks being formed as arcs of circles having a common center, whereby each of the spaces intermediate the several courses of checker bricks is uniform in width from one side to the other thereof.

5. A furnace for high temperature operations, comprising lateral walls and an arched crown defining a flame space, a regenerator disposed above said flame space and above at least a part of said arched crown, a passage for conducting gaseous media between said flame space and the lower portion of said regenerator, a passage leading to the upper portion of said regenerator for conducting gaseous media to and from the regenerator and a plurality of courses of checker bricks making up the heat transferring means of said regenerator and having passages therethrough providing for the flow of gaseous media between the upper and lower portions of the regenerator, each course being formed as at least a part of an arch and being supported as an arch independently of the other courses, whereby the weight load of said checker bricks may be supported predominantly through the lateral side walls and said arched crown not be subjected to the major portion of such weight load.

6. A furnace for high temperature operation, comprising lateral walls and an arched crown defining a flame space, a pair of regenerators disposed above said arched crown and having a common dividing wall therebetween above substantially the center of said arched crown and extending along the high portion thereof, a plurality of courses of checker brick disposed in each of said pair of regenerators, each of said courses being formed as substantially half an arch and being opposite a similar half arch of checker brick in the other of said pair of regenerators, said common dividing wall being arranged in the position of the keystones of the several arches of checker bricks, whereby the weight load of the checker bricks may be supported predominantly by the lateral outer walls of the regenerators and said arched crown will not be subjected to a major proportion of such weight load.

7. A furnace for melting glass, comprising a glass containing basin including a bottom and side walls for confining a bath of molten glass, lateral wall portions and an arched crown de-

fining a flame space above said bath of molten glass, a pair of regenerators disposed above at least a portion of said arched crown and communicating with said flame space, and a plurality of vertically spaced half arches of checker brick built within each of said pair of regenerators, each of said half arches being respectively opposite a similar half arch in the other of said pair of regenerators, said arched crown and each of said half arches being formed on the arcs of circles all having a common center, whereby each of the spaces between the several half arches will be uniform in width from side to side thereof, and the checker bricks making up each of said half arches being so disposed and arranged that the openings through any one half arch will be in alignment with a checker brick in the half arch immediately above and below the one in question and will be out of alignment with the openings in such half arches immediately above and below the one in question.

CHARLES F. RYAN.