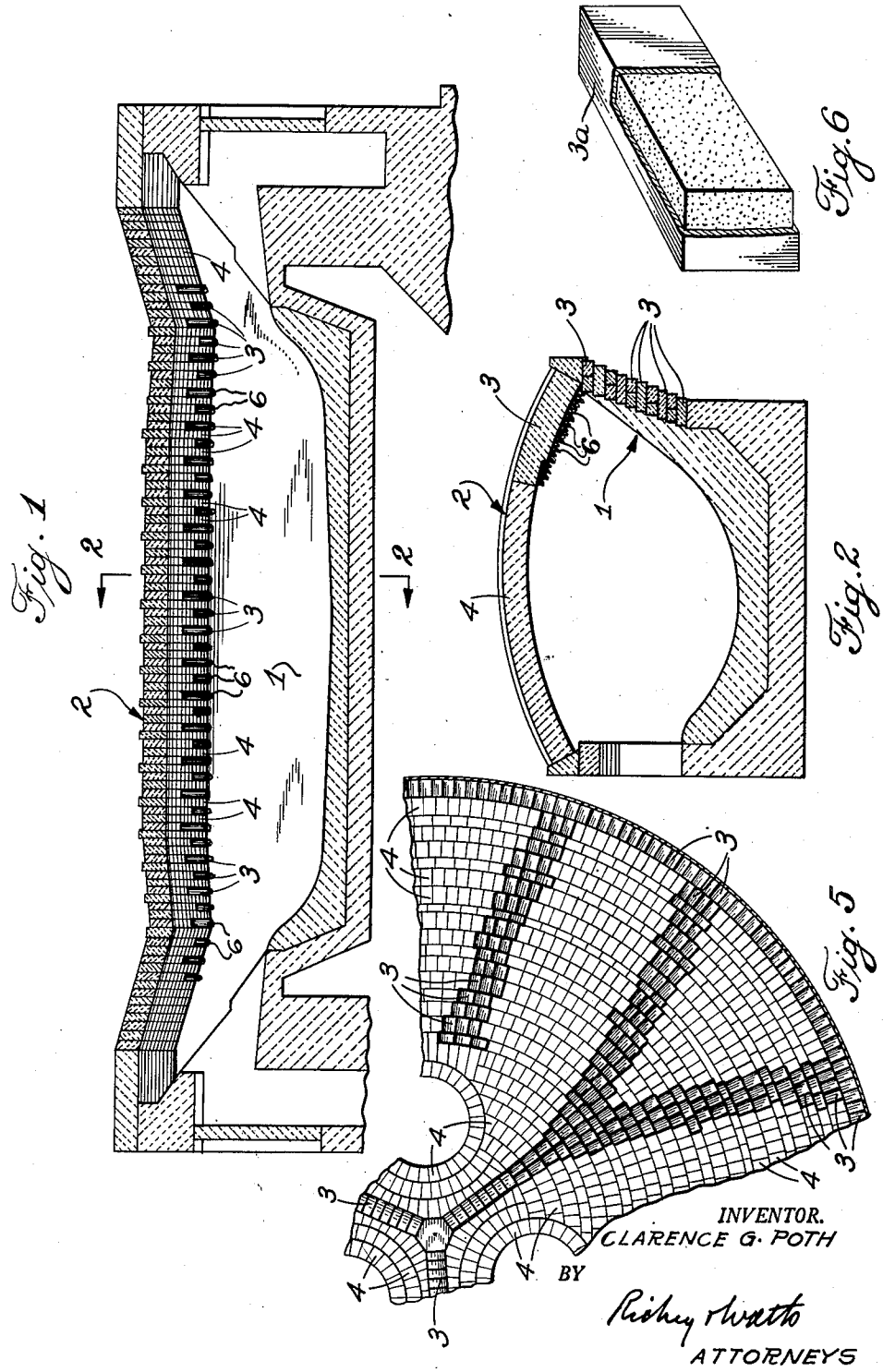
March 2, 1954 C. G. POTH 2,670,698

FURNACE ROOF

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Fig. 3

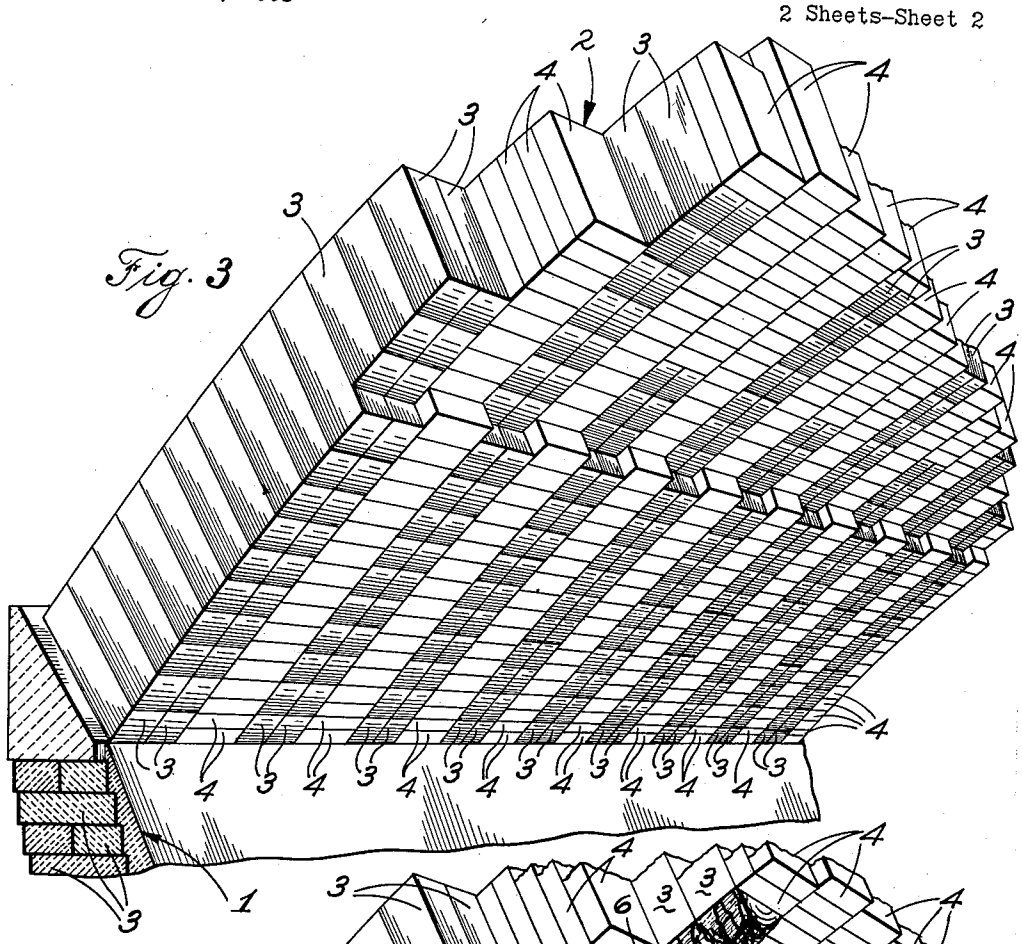
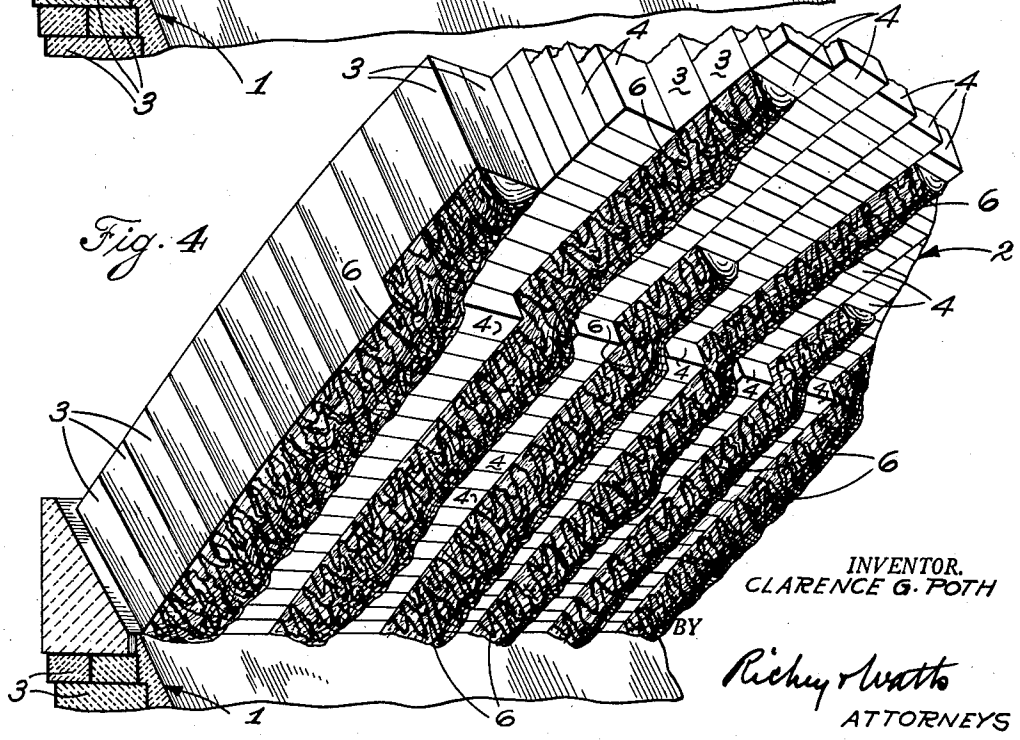


Fig. 4



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FURNACE ROOF

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9 Claims. (Cl. 110—99)

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This invention relates generally to wall construction for metallurgical furnaces and is particularly concerned with a brick work construction which is suitable for the walls of such furnaces which are subjected to the most severe service conditions, such as the roof and knuckle walls of an open hearth furnace and electric furnace roofs.

Many efforts have been made heretofore to improve the roof construction of metallurgical furnaces, such as open hearth and electric furnaces used in the steel industry, but there is still much to be desired in the most highly developed roof constructions of the present day. Such roofs have a short life at best before patching is required and repeated patching must be done frequently to keep the furnace in operation. Much longer roof life is desirable because of the expense required for patching or replacing the patched roof, this expense including the loss of production during the time the furnace is being so repaired.

There are comparatively few materials which are at all suitable for use as roof construction material in open hearth furnaces and the like. Chief among these materials are silica brick and basic brick.

Silica bricks are well suited to such use in a number of respects. They are strong, begin to melt at a temperature of approximately 3,000° F. and are resistant to erosion by gases. However, the heat conductivity of silica bricks is considered only fair.

Basic bricks are suitable for such use in some respects but not in other respects. As compared with silica brick they are much heavier but they are weaker, more resistant to erosion and begin to melt at higher temperatures. Basic bricks are so heavy that a large open hearth roof constructed of them must be supported by suspending means.

Proposals have been made to use only metal-covered basic brick in furnace roof constructions but such proposals have not solved the problem because iron oxide which was formed on or picked up by the double thickness of metal between the rows of bricks resulted in growth of the bricks and resultant buckling and spalling of the roof.

The present invention is predicated on the discovery that new and unexpected results may be obtained by utilizing in furnaces of the type here under consideration a wall construction comprising rows of silica brick on opposite sides of one or two rows of basic brick, each of the basic bricks, preferably but not necessarily, being encased in a metal shell. It has been found in

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actual practice that when furnaces have such a construction in the parts of the roof and knuckles which are subjected to the most severe operating conditions, they possess much longer lives than when the best conventional constructions known today are used. Furnaces embodying this invention may be operated to make many more heats before the first patching is required than similar furnaces constructed according to the best conventional practice, and to make at least as many heats as the best conventional furnace between successive patchings. As illustrative of these new and surprising result, it may be said that open hearth furnaces embodying the present invention have been operated to produce 50% more heats before the first patching than was possible with the best conventional prior art roof construction.

The new and surprising results attained by the present invention are believed to be traceable to the new combination of parts and the new resulting mode of operation. The combination of silica and basic brick protects the construction against erosion, oxides and resultant spalling. This in turn strengthens the construction by bonding the bricks together. It enables the more highly conductive basic brick to conduct heat away from the silica brick and thereby keep the temperature of the latter at a lower level. The arrangement of the rows of silica and basic bricks prevents any material lateral growth and keeps buckling of the roof at the minimum. As a result the roof is light enough and strong enough and shape and size maintaining to be self-supporting and not to require overhead supports. Moreover, the surfaces of the basic brick which are exposed to the gases rapidly pick up ferrous oxide from the gases and thus the surfaces of these brick grow inwardly beyond the inner surfaces of the silica bricks. This inward extension of the basic brick gives a sort of washboard effect to the furnace wall and affords protection to the silica brick against the erosive effects of the gas since the rapid flow of the gases is interfered with and the gases are agitated and are deflected away from the silica brick by the rib-like projection of the basic bricks.

The present invention will be better understood by those skilled in the art from the drawings which accompany and form a part of this specification and in which:

Fig. 1 is an elevational view partly in section taken longitudinally of an open hearth furnace embodying the present invention;

Fig. 1 is a transverse, sectional view of the furnace of Fig. 1;

Fig. 3 is a perspective-like view of a part of the roof of Fig. 1 on an enlarged scale;

Fig. 4 is a perspective-like view of a furnace roof embodying the present invention after having been in use for some time;

Fig. 5 is a fragmentary, bottom, plan view of an electric furnace roof embodying the present invention; and

Figure 6 is a perspective view of one of the metal encased basic bricks.

In Figs. 1, 2 and 3, the back wall of an open hearth furnace is indicated at 1 and part of the roof is indicated at 2. This roof includes rows 3 of basic brick encased in metal 3*a* and rows 4 of silica bricks. The rows 3 of metal covered bricks are preferably arranged in pairs, each pair extending varying distances from the back wall 1 so that the ends of adjacent rows in the roof do not lie on the same line longitudinally of the furnace. One or more rows of silica bricks may be interposed between two pairs of rows of the metal covered basic bricks. If desired, the basic bricks may be laid in single rows and one or more rows of silica brick may be laid between adjacent single rows of the basic bricks.

It has been found that it is unnecessary to extend the rows of metal covered basic bricks all the way across the roof of the furnace and when these rows extend upwardly along the roof approximately as is shown in Figs. 1 and 3, excellent results, in terms of the number of heats that can be made in a furnace before patching is required, may be expected.

Fig. 4 shows, fragmentarily, the appearance of the inner surface of the open hearth furnace roof embodying the present invention after long continued use thereof. In this figure, 3 indicates rows of basic brick which were covered with metal, and 4 indicates silica brick, both as shown in Figs. 1 to 3. It will be noted that the lower or inner surfaces of the metal covered bricks have material 6 adhering thereto which projects downwardly well beyond the inner surfaces of the silica bricks. This material includes iron oxides which were carried by the gases and were deposited on the metal covering 3*a* of the basic bricks. This adhering material gives the inner surface of the roof a washboard effect as can be seen in Fig. 4, the effect of which configuration is that gases flowing along the roof are agitated and deflected away from the silica brick and the eroding effect of the gases is surprisingly decreased with resultant prolonged life of the silica bricks.

Fig. 5 shows the lower side of an electric furnace roof in which the basic brick 3 are arranged in rows extending along generally radial lines in the roof with the silica brick 4 completing the roof. While the arrangement of bricks in this roof is not exactly like that in the open hearth furnace roof of Figs. 1 to 4, this operation and results are substantially the same.

It has also been discovered, as a result of tests of this invention in roofs of metallurgical furnaces operating over long periods of time, that the basic bricks become fused to the silica brick during use and, hence, have a fairly good heat conducting connection thereto. The use of metal cases on the basic bricks improves the heat conducting contact with the adjacent silica bricks and thus act as good conductors to carry heat from the silica bricks into the basic bricks whence it may be carried away more rapidly than through the silica bricks themselves with resultant maintenance of the roof at a lower temperature than would otherwise be the case.

In the appended claims the expression "complete solid wall or roof wall" refers to the brick portion of the wall or roof and is not intended to exclude openings such as the electrode holes in the roof of the electric furnace of Figure 5.

Having thus described the present invention so that others skilled in the art may be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. A complete solid wall for a metallurgical furnace comprising a plurality of rows of silica bricks and a plurality of composite rows of bricks arranged alternately with said rows of silica bricks, each of said composite rows consisting of basic bricks disposed in juxtaposed relationship with each other thereby constituting a continuous part of said row and silica bricks constituting the remainder of said row, the numbers of basic bricks being different in adjacent composite rows with the basic bricks at one end of the basic brick parts of said rows being positioned in staggered relation relative to each other.

2. A complete solid wall for a metallurgical furnace comprising a plurality of rows of silica bricks and a plurality of composite rows of bricks arranged alternately with said rows of silica bricks, each of said composite rows consisting of basic bricks constituting a continuous part of said row and silica bricks constituting the remainder of said row, the numbers of basic bricks being different in adjacent composite rows with the basic bricks at one end of said rows being positioned in staggered relation relative to each other, and ferrous metal covering the surfaces of the basic bricks which are exposed to gases in the furnace.

3. In a metallurgical furnace having a chamber defined in part by an upstanding wall, a complete roof wall comprising a plurality of rows of bricks extending from said wall upwardly and inwardly and partly defining said chamber, certain of said rows consisting of silica bricks, and certain other composite rows consisting of basic bricks and silica bricks with the basic and silica bricks constituting respectively the parts of said composite rows adjacent to and remote from said wall, the basic brick portions of some of said composite rows being shorter than the basic brick length of certain other rows of bricks.

4. In a metallurgical furnace having a chamber defined in part by an upstanding side wall, a complete roof wall comprising a plurality of transverse rows of bricks positioned to extend upwardly and at an angle to said side wall of the furnace, certain of said rows consisting of silica bricks and certain other rows arranged alternately therewith and consisting of basic bricks positioned to extend upwardly from said side wall and silica bricks to extend from the upwardmost basic bricks, the upwardmost basic bricks in adjacent composite rows being positioned to lie at different distances from said side wall and in staggered relation relative to one another.

5. In a metallurgical furnace having a chamber defined in part by an upstanding side wall, a complete roof wall comprising a plurality of transverse rows of bricks positioned to extend upwardly and at an angle to said side wall of the furnace, certain of said rows consisting of silica bricks and certain other rows arranged alternately therewith and consisting of basic bricks

positioned to extend upwardly from said side wall and silica bricks to extend from the upwardmost basic bricks, the upwardmost basic bricks in adjacent composite rows being positioned to lie at different distances from said side wall and in staggered relation relative to one another, and ferrous metal covering the surfaces of the basic bricks which are exposed to furnace gases.

6. In an open hearth furnace having a chamber defined in part by upstanding front and back walls, a complete roof wall comprising a plurality of transverse rows of bricks positioned to extend from the back wall of the furnace to its front wall at substantially right angles to said walls, certain of said rows consisting of silica bricks and certain other rows arranged alternately therewith and consisting of basic bricks positioned to extend forwardly from the back wall and silica bricks extending from the forwardmost basic bricks to the front wall, the forwardmost basic bricks in adjacent composite rows lying at different distances from the back wall and in different planes extending longitudinally of the furnace.

7. In an open hearth furnace having a chamber defined in part by upstanding front and back walls, a complete roof wall comprising a plurality of transverse rows of bricks positioned to extend from the back wall of the furnace to its front wall at substantially right angles to said walls, certain of said rows consisting of silica bricks and certain other rows arranged alternately therewith and consisting of basic bricks positioned to extend forwardly from the back wall and silica bricks extending from the forwardmost basic bricks to the front wall, the forwardmost basic bricks in adjacent composite rows lying at different distances from the back wall and in different planes extending longitudinally of the furnace, and ferrous metal covering the lower exposed surfaces of said basic bricks.

8. In an electric furnace having a chamber defined in part by an upstanding generally circular outer wall, a complete roof wall comprising a plurality of generally radial rows of bricks positioned to extend from the outer wall of the furnace to its center, certain of said rows consisting of silica bricks and certain other rows arranged alternately therewith and consisting of basic bricks positioned to extend from said periphery toward the center of the roof and silica bricks extending from the innermost basic bricks toward the center of the roof, the innermost basic bricks in adjacent rows containing basic bricks lying at different distances from the said periphery and in different circles concentric with said periphery.

9. In an electric furnace having a chamber defined in part by an upstanding generally circular outer wall, a complete roof wall comprising a plurality of generally radial rows of bricks positioned to extend from the outer wall of the furnace to its center, certain of said rows consisting of silica bricks and certain other rows arranged alternately therewith and consisting of basic bricks positioned to extend from said periphery toward the center of the roof and silica bricks extending from the innermost basic bricks toward the center of the roof, the innermost basic bricks in adjacent rows containing basic bricks lying at different distances from the said periphery and in different circles concentric with said periphery, and ferrous metal covering the lower exposed surfaces of the basic bricks.

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