Dec. 25, 1928. 1,696,812

O. NYGAARD ET AL

FURNACE WALL AND BRICK THEREFOR

Filed Feb. 3, 1926 2 Sheets-Sheet 1

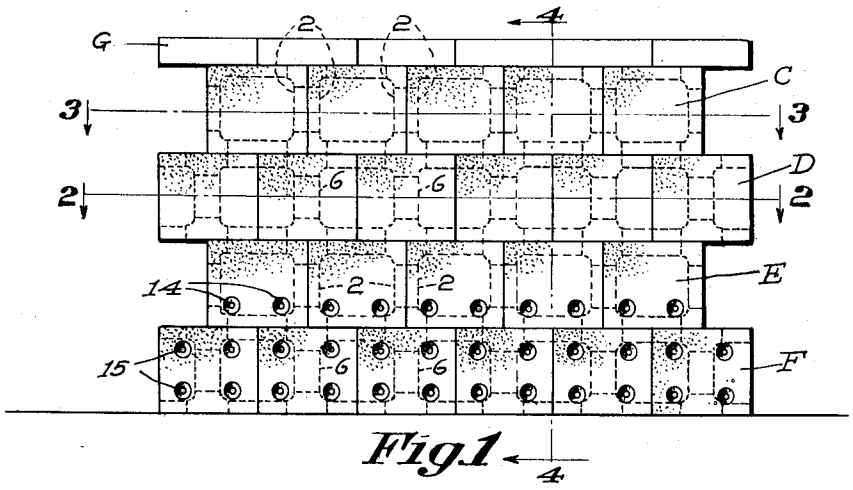


Fig. 1

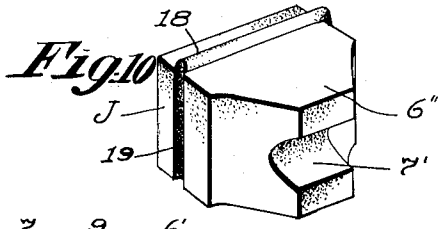


Fig. 10

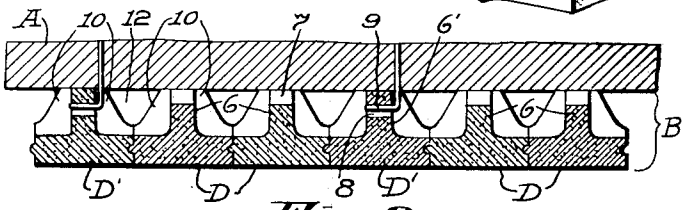


Fig. 2

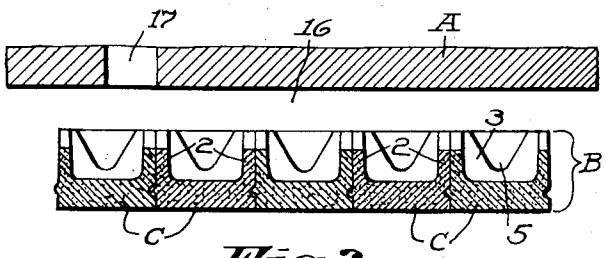


Fig. 3

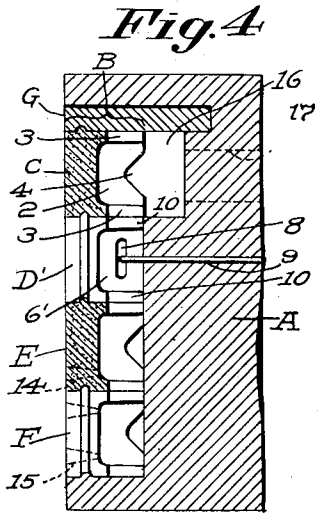


Fig. 4

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2 Sheets-Sheet 2

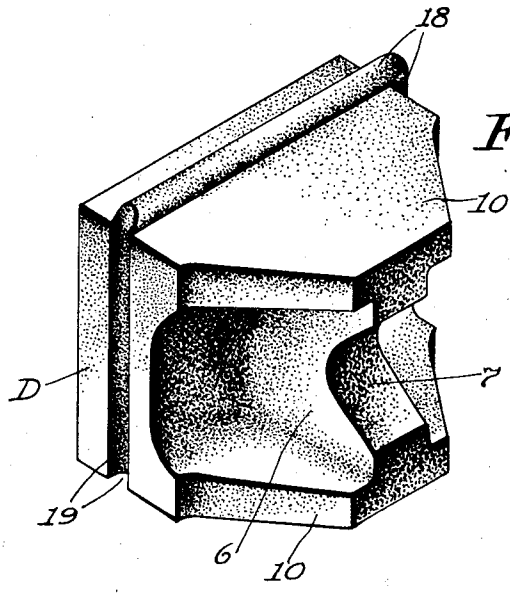


Fig. 5

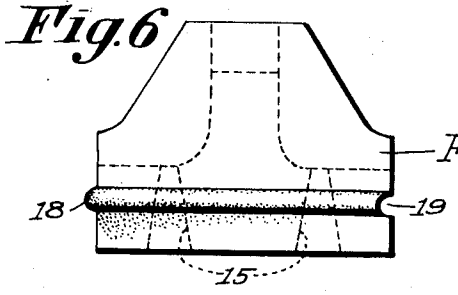


Fig. 6

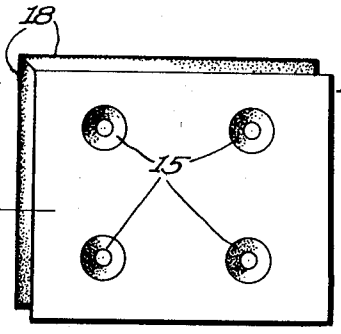


Fig. 7

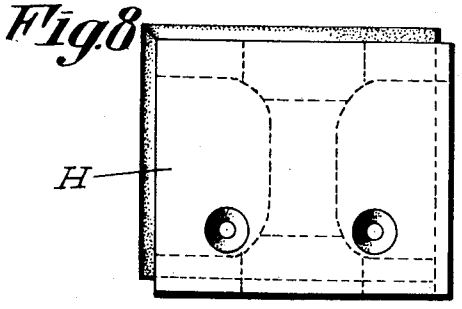


Fig. 8

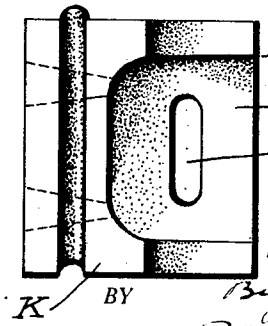


Fig. 9

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UNITED STATES PATENT OFFICE.

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FURNACE WALL AND BRICK THEREFOR.

Application filed February 3, 1926. Serial No. 85,682.

This invention relates to furnace walls and to bricks for use in the construction of such walls.

Air cooled furnace walls of the general type shown, for example, in the Bernitz Patent No. 1,393,606 are now used quite commonly, especially in those installations which are subjected to sustained operation at high temperatures. This type of wall, if properly built, has a much longer life than walls of prior constructions, it effects important economies in maintenance, and reduces very materially the interruptions in service necessitated by the rebuilding or repairing of furnace walls. The present invention aims to improve and perfect furnace wall constructions of the general character above designated with a view to effecting further economies in the building and up-keep of such walls, while at the same time improving the mechanical strength and rigidity of walls of this type. The invention also provides a brick of novel construction which is especially adapted for use in building walls of the character above indicated. While we have referred to said Bernitz patent by way of example, it is to be understood that the uses of our invention are not limited to what is shown therein but extend to any air cooled furnace wall, such walls having a wide variety of uses, as in pulverized fuel furnaces, etc.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a front elevation of a portion of a furnace wall constructed in accordance with this invention;

Figs. 2, 3 and 4 are cross-sectional views on the lines 2—2, 3—3 and 4—4, respectively, of Fig. 1;

Fig. 5 is a perspective view of a novel form of brick embodying one feature of this invention;

Figs. 6 and 7 are top and front views of a modified construction of brick;

Fig. 8 is a front view of a further modification;

Fig. 9 is a side view of still another form of brick; and

Fig. 10 is a perspective view of a brick somewhat like, but different from, the construction shown in Fig. 5.

Referring first to Figs. 1 to 4, inclusive, it will be observed that the wall there shown comprises a rear section A and a front section B. The rear section usually is made of ordinary fire brick laid up in the usual manner, while the front section is composed of special bricks, arranged in superposed courses, with the bricks in one course breaking joints with those in the next course.

In the drawings only four of these courses are shown, although this number obviously may vary with the requirements of each individual installation. The bricks or blocks C in the uppermost course are of box-like form and have a relatively thin front wall or body portion with upright flanges 2—2, Figs. 3 and 4, projecting rearwardly from opposite ends thereof, and horizontal flanges 3—3 projecting rearwardly from the top and bottom thereof. Each of the vertical flanges has a deep notch 4 formed through it laterally and these notches in adjacent blocks register with each other and afford lateral communication between the spaces or chambers in the adjacent blocks C. Similarly, each horizontal flange 3 has a notch 5, Fig. 3, formed in it, preferably deeper than the notches 4, and the notches 5 in the bricks of superposed courses cooperate to afford vertical communication between the chambers or spaces in the bricks in said courses. Preferably these bricks or blocks are made of silicon carbide, carborundum, or the like, although they may also be made of fire clay, or any other suitable material.

The second course from the top in the front section of the wall shown is composed of bricks D and D′, and, as best shown in Fig. 2, each of these bricks is of approximately T-shape in central horizontal cross-section. Each brick has a front wall or body portion of approximately the same thickness as the front wall of the brick C, and it also has a vertical flange or projection 6 extending rearwardly from the central portion of said front wall, this flange having a notch 7 therethrough of approximately the same di-

mensions as one of the notches 4 of the bricks C above described. Each of these bricks D and D′ also has plate-like extensions or flanges 10 at the top and bottom thereof, these flanges being cut away or notched so that when they are placed side by side in a course, as shown in Fig. 2, a space or notch 12 is formed between them of the same dimensions as the notches 5 in the bricks C. The bricks D′ are of exactly the same construction as the bricks D except that the vertical flange 6′ of the brick D′ is not notched but is recessed or apertured, as shown at 8, to receive the angular end of a tie bar 9, the shank of which is anchored in the rear section A of the wall.

The bricks E in the second course from the bottom, Fig. 1, are of the same construction as the bricks C except that they are each provided with two apertures or holes 14 formed through the front wall thereof for the passage of air into the furnace chamber or the fuel bed.

The blocks F in the lowermost course, Fig. 1, are like the blocks D except that they are provided with air discharging apertures 15 similar to the apertures 14.

The rearwardly extending flanges or projections of all these bricks are of substantially the same height as their respective bricks, and the bricks are of uniform dimensions from their front faces to the rear edges of their flanges. Consequently, in building the front wall section B from these bricks the ends of the flanges are abutted against the rear wall A, and the flanges therefore definitely space the front walls of the bricks from the rear wall section A. It should also be observed that the two upright end flanges 2—2 of any pair of abutting bricks C are superposed upon the central flange 6 of the bricks D in the next lower course. These flanges 6, in turn, are placed directly upon the end flanges 2—2 of the bricks E, and the latter are superposed upon the central flanges 6 of the bricks F. In other words, the vertical flanges of the bricks of each course are superposed upon the vertical flanges of the bricks in the next lower course. Preferably, also, the vertical flange 6 of each brick D or F is substantially equal in width to the combined thickness of the abutting flanges 2—2 of the bricks in the courses C and E. Since each flange is continuous for the entire height of its respective brick, the superposed flanges cooperate to form vertical supports extending from the top to the bottom of the front section and from the front to the rear of said section. This provides a front wall section which is very strong and rigid mechanically, the front section is braced against the rear section A by the contact of the flanges with said rear section, and it may be tied to the rear section by the tie bars 9.

At the upper edge of the front section as illustrated the divided wall ends, and a solid wall is superposed upon it, the lower course of brick in this solid wall being shown at G, Fig. 1. A suitable arrangement for supplying air to the space between the front and rear wall sections B and A, is to provide a space 16, Fig. 4, in the section A immediately at the rear of the top course of hollow bricks, this space extending practically for the entire length of the front section. One or more air ducts 17 lead air under pressure into the space 16, and the air flows downwardly through the superposed notches 5 and 12 to the bricks in the lower courses which may be provided with air discharging openings 14 and 15. Air escapes through these openings into the fuel bed or into the combustion chamber in the furnace. In some installations, also, a header or space similar to that shown at 16 is provided at the lower end of the front wall section A, and air ducts (not shown) communicating with it conduct the air away from the space between the wall sections. As the air circulates between the front and rear sections of the wall, it flows against the rear surfaces of the body portions or front walls of the bricks C, D, E and F, and carries the heat away from these portions of the bricks, thus keeping the temperature of the front section of the wall within the desired limits. The flanges also assist in keeping the front wall of the brick cool since they conduct heat from this wall to the air and they expose a large heat radiating surface to the action of the cooling current of air. The lateral communication afforded by the notches 4 and 7 in the vertical flanges of the bricks permits a free horizontal flow of air between adjacent vertical air columns and equalizes any variations in pressure laterally between different parts of the air space provided in the wall. A very free circulation of air thus is provided immediately behind, and in contact with, the front wall portions of the bricks C, D, E and F so that the desired advantages of uniform and efficient air cooling are obtained. At the same time this construction has the advantage of added mechanical strength and stability.

The T-shaped bricks D are shown on a larger scale in Fig. 5 which is a perspective view of the top and rearward side of one of these bricks. This view shows very clearly the plate-like extensions 10—10 extending rearwardly from the top and bottom of the front wall or body portion of the brick, the vertical web 6 which, with portions of the extensions 10—10 form the central upright flange or projecting portion, and the notch or passage 7 in this flange. It will be observed that the rear part of this brick is chambered out at opposite sides thereof for the greater part of its height, thus making the intermediate portion of the vertical flange 6 relatively thin, and at the same time provid-

ing a front wall which is comparatively thin, say for example, two and one-half inches in thickness. The thin front wall is of advantage, when the brick is made of silicon carbide or similar refractory material, in effecting a more rapid transmission of heat from the front face of the brick to the rear surface where this heat is swept away by the cooling current of air. This construction is especially advantageous in permitting a more accurate control of the temperature at the front face of the brick, and in being very economical of material, which is an important consideration in bricks made of silicon carbide.

The deep grooving of the back of the block and the construction of the flanges permits a free circulation of air against the rear surface of the front wall of the brick, so that the differences in temperature of the flanges and the front wall or body portion of the brick is greatly reduced, and the internal stresses set up in the brick by changes in temperature are correspondingly reduced. This practically eliminates the difficulties which have been experienced with prior constructions of bricks in the breaking off of the flanges from the front wall or body portion which have proved a very serious objection to such constructions.

When a brick of this general type is to be made of fire clay, the rearwardly extending vertical flange 6″ is preferably not chambered out at opposite sides, as shown in Fig. 5, but the flange preferably is made as shown in Fig. 10, the bricks shown in these two figures, in other respects, being the same. It will be observed that the flange 6″ of this brick is very wide where it joins the body portion of the brick and gradually decreases in width as it extends rearwardly. This flange 6″ is substantially the same size throughout its length as the face or end 10′ thereof. This construction, therefore, is better adapted for a clay brick than the design shown in Fig. 5 which includes thinner and more fragile parts. At the same time the brick shown in Fig. 10 is well adapted for use in walls which are not subjected to sufficiently high temperatures to make advisable the use of bricks made of silicon carbide.

In all of the bricks used in the front section B of the wall, we prefer to provide the edges of the body portions with tongues 18 and grooves 19 so that the front walls or body portions of these bricks will be interlocked with each other or bonded together by this tongue and groove construction. This facilitates the laying of the bricks and is of advantage in securely holding the front portions of the bricks in the wall even if the flanges of certain of the bricks should become cracked or broken off.

Figs. 6 and 7 show the brick F, Fig. 1, on a larger scale, this brick being like the brick D, Fig. 5, except that it is provided with tapered air discharging apertures 15.

Fig. 8 shows a brick H like that shown in Fig. 5 except that it is provided with two air discharging apertures. The brick K, Fig. 9, is like the brick F except that its flange 20 is not notched but is provided with a slot or passage 8′ like that in the bricks D′, and for the same purpose, namely, to receive the angular end of a tie bar 9. In addition, the slots 8 of the bricks D′ and the slots 8′ of the bricks K also perform the same functions as the notches 7 in permitting a horizontal or lateral flow of air through the spaces at the backs of the bricks. In the construction shown the top and bottom edge faces of the flanges are flush with, and form continuations of, the top and bottom edge faces of the front wall or body portion of the brick. While this is the preferred construction, particularly when the method illustrated of tying the front and rear wall sections together is used, it will be evident that the invention is not limited to this particular construction.

The bricks provided by this invention require less material in their construction than prior bricks of which we are aware and which are designed to perform the same functions, they facilitate the building of the front section of the furnace wall, and a wall construction made from them has unusual mechanical strength and rigidity.

While we have herein shown and described the best embodiment of our invention that we have so far devised, it is contemplated that the invention may be embodied in other forms without departing from the spirit or scope thereof. It will be understood that the furnace wall built in the manner above described may constitute only a portion or section of the entire height of the whole wall and this often is the case in practice, the air cooled wall extending only through that region which is subjected to higher temperatures.

The box-type of block above mentioned is not claimed in this application, but it is claimed in another application filed of even date herewith, Serial No. 85,683.

Having thus described our invention, what we desire to claim as new is:

1. A furnace wall structure comprising superposed courses of bricks, composed entirely of refractory materials, the bricks in one course breaking joints with those in the next course, said bricks having upright rearwardly projecting portions with the projecting portions of the bricks in one course superposed on the projections of the bricks in the next lower course, said wall having vertical air passages across adjacent courses, formed by said portions, to permit a vertical flow of air past the rear faces of the bricks.

2. A furnace wall structure comprising superposed courses of bricks, composed en-

tirely of refractory materials, the bricks in one course having upright projections extending rearwardly from opposite ends thereof and the bricks in the next adjacent course each having an upright projection extending rearwardly from the central part thereof, said projections in one course overlying those in the next lower course, said wall having vertical air passages across adjacent courses formed by said flanges.

3. A furnace wall structure comprising superposed courses of bricks composed entirely of refractory materials, the bricks in one course having upright projections extending rearwardly from opposite ends thereof and the bricks in the next adjacent course each having an upright projection extending rearwardly from the central part thereof, the two adjoining end projections of bricks in one course being alined with the central projection of a brick in the next lower course.

4. A furnace wall structure having front and rear sections of fireproof material, said front section comprising superposed courses of bricks made of highly refractory material having upright rearwardly projecting portions abutting against the rear section and thereby spacing a part of said front section from said rear section, the projecting portions of the bricks in one course overlying the projecting portions of the bricks in the next lower course, said wall having vertical air passages across adjacent courses, formed by said portions, and permitting a circulation of air between said front and rear sections.

5. A furnace wall structure having front and rear sections of fireproof materials, said front section comprising superposed courses of bricks made of highly refractory materials having upright rearwardly projecting portions abutting against the rear section and thereby spacing a part of said front section from said rear section the projecting portions of the bricks in one course overlying the projecting portions of the bricks in the next lower course, said wall having vertical air passages across adjacent courses formed by said portions and means cooperating with certain of said projecting portions to tie said front and rear sections together.

6. A furnace wall structure having front and rear sections of fireproof material, said front section comprising superposed courses of bricks made of highly refractory material having upright rearwardly projecting portions abutting against the rear section and thereby spacing a part of said front section from said rear section, the projecting portions of the bricks in one course extending rearwardly from opposite ends of the bricks and the bricks in the next adjacent course each having its projecting portion extending rearwardly from the central part thereof, the two adjoining end projecting portions of bricks in one course being alined with the central projecting portion of a brick in the next lower course.

7. A brick for furnace wall construction comprising a relatively thin front wall, flat platelike extensions projecting rearwardly from said wall at the top and bottom thereof, said extensions being wide at said wall and decreasing in width as they extend rearwardly, and a relatively thin upright web projecting centrally from the back of said wall and connecting said extensions.

8. A furnace wall having front and rear sections of fireproof material, said front section comprising superposed courses of bricks made of highly refractory material the bricks in one course breaking joints with those in the next course and having upright rearwardly projecting extensions abutting against said rear section with the extensions of the bricks in one course overlying the extensions of the bricks in the next lower course, said extensions in each course being laterally spaced from each other and cooperating to form vertical air passages between said wall sections, the extensions being shaped to afford lateral communication between said passages.

9. A furnace wall structure comprising superposed courses of bricks, the bricks in one course breaking joints with those in the next course, the bricks in one course having upright extensions projecting rearwardly from opposite ends thereof and the bricks in the next adjacent course each having an upright extension projecting rearwardly from the central part thereof, said center extension of each brick in one course being superposed on, and substantially equal in width to, the two end extensions of abutting bricks in the next lower course, said extensions being substantially equal in height to the height of their respective bricks, and certain extensions having cut away portions to provide communication between opposite sides thereof.

10. A brick for furnace wall construction comprising a body portion forming the front wall of the brick, and a continuous upright extension projecting rearwardly from the central part of said body portion and of substantially the same height as said body portion, said brick consisting of refractory material and said extension being approximately as wide as said body where it joins the body and decreasing in width as it extends rearwardly, and having a cut away portion providing communication between opposite sides of said extension.

11. A brick for furnace wall construction comprising a relatively thin front wall, flat platelike extensions projecting rearwardly from said wall at the top and bottom thereof, with their upper and lower faces, respectively, forming substantially continuations of the top and bottom faces of said wall, said extensions being relatively wide at said wall

and decreasing in width as they extend rearwardly, and an upright web projecting rearwardly from said wall and connecting said extensions.

12. A furnace wall having front and rear sections separated by substantially continuous vertical supports spaced laterally from each other to provide vertical air passages between said sections, said front section including superposed courses of bricks made of refractory material and having upright rearwardly projecting extensions abutting against the rear section, the bricks in one course breaking joints with those in the next course, the extensions of the bricks in one course overlying extensions of the bricks in the next lower course, and said extensions in superposed courses being included in said supports, said extensions being shaped to provide lateral air passages between said vertical air passages.

13. A furnace wall having front and rear sections, said front section including superposed courses of bricks, the bricks in one course breaking joints with those in the next course, the bricks in one course having upright extensions projecting rearwardly from opposite ends thereof and the bricks in the next adjacent course each having an upright extension projecting rearwardly from the central part thereof, the center extensions of the bricks in one course being superposed on the two end extensions of abutting bricks in the next lower course, said extensions abutting against said rear section of the wall, whereby the extensions cooperate to form substantially continuous supports separating said front and rear wall sections and providing vertical air passages between the supports, and certain of said extenisons being shaped to afford lateral communication between adjacent air passages.

14. A brick for furnace wall construction comprising a body portion forming the front wall of the brick, a continuous upright extension projecting rearwardly from said front wall and of substantially the same height as said wall, said extension being wide at said wall and decreasing rapidly in width as it extends rearwardly, and the intermediate portion of said extension being chambered out at opposite sides thereof, whereby said intermediate portion is made relatively thin.

15. A brick for furnace wall construction comprising a body portion forming the front wall of the brick, a continuous upright extension projecting rearwardly from said front wall and of substantially the same height as said wall, said extension being wide at said wall and decreasing rapidly in width as it extends rearwardly, the intermediate portion of said extension being chambered out at opposite sides thereof for the greater part of its height, whereby said intermediate portion is made relatively thin, and a notch formed in the rearward edge of said intermediate portion to provide for a free flow of air between the chambers formed at opposite sides of said extension.

In testimony whereof we have signed our names to this specification.

OSCAR NYGAARD.
BENJAMIN H. SNOW.