Feb. 24, 1942. A. P. SHORT 2,273,898

FURNACE WALL

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Fig. 1.

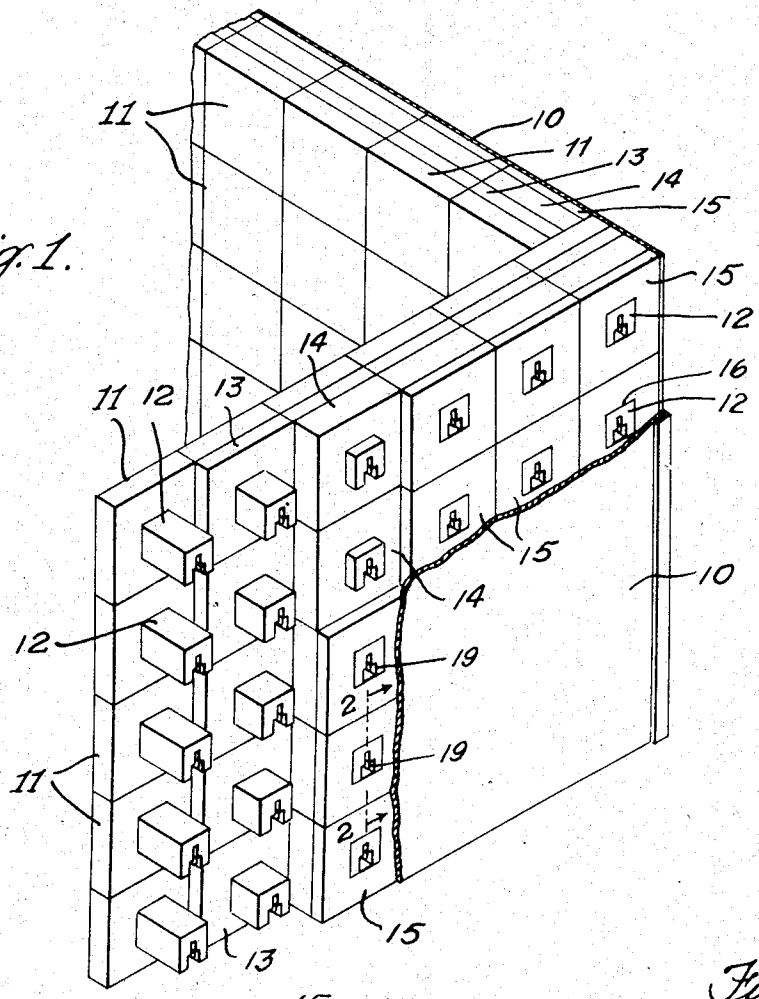


Fig. 2.

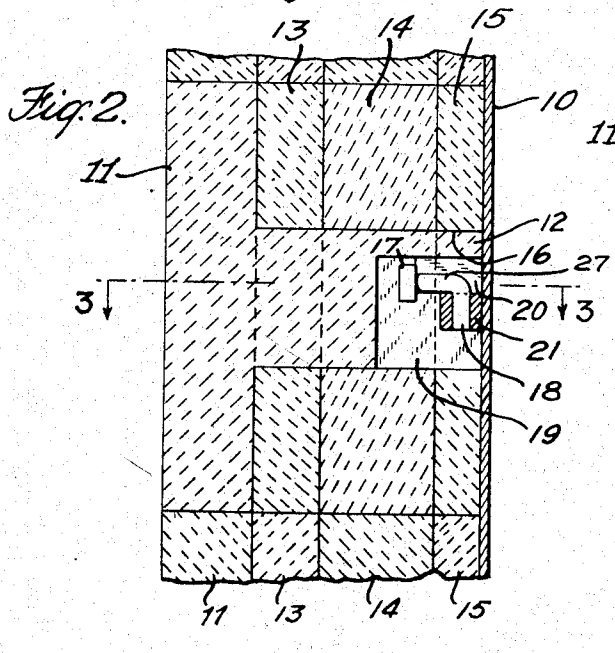
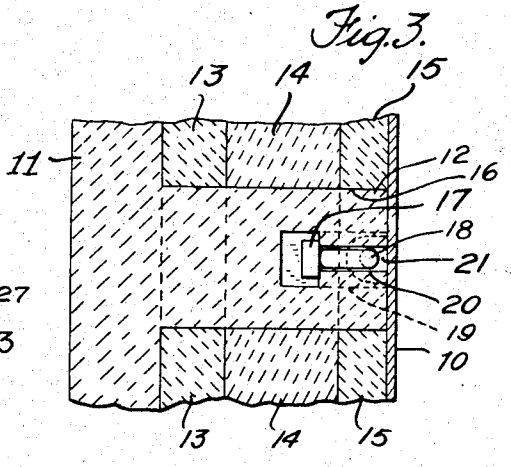


Fig. 3.



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Fig. 4.

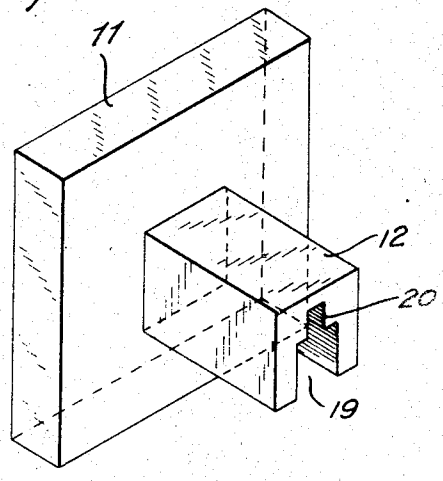


Fig. 5.

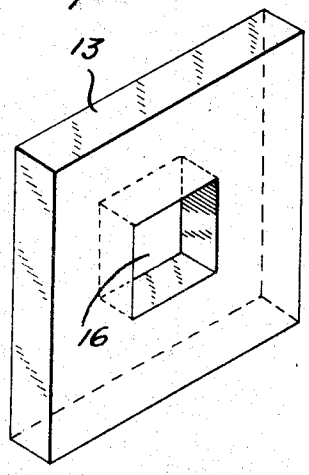


Fig. 6.

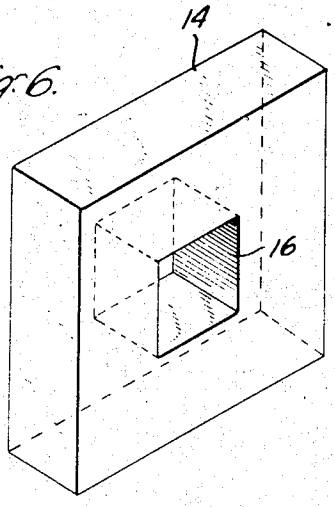


Fig. 7.

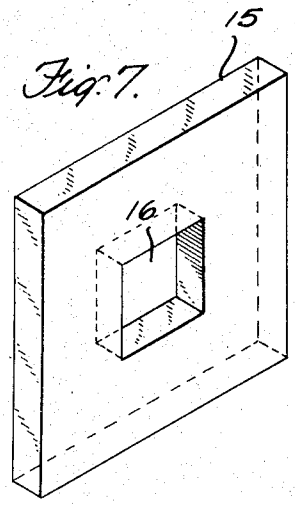


Fig. 8.

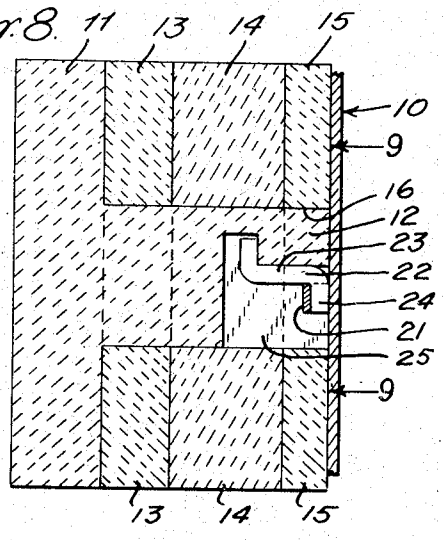
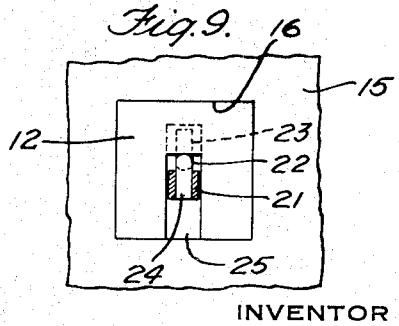


Fig. 9.



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2,273,898

FURNACE WALL

Albert P. Short, Upper Darby, Pa.

Application February 3, 1940, Serial No. 317,115

14 Claims. (Cl. 72—102)

This invention relates to furnaces and more particularly pertains to refractory and insulation walls of furnaces and the attachment or fastening of these walls to the metal casings external thereto. The invention is particularly well adapted to marine boiler furnaces, but it is applicable to stationary boiler furnaces, and it is utilizable also in incinerators, kilns, or any other receptacle in which combustion, or other heat producing action, or chemical reaction occurs, or is caused to take place.

The firebrick comprising the refractory linings of marine boiler furnaces in use about twenty years ago, was secured to the steel furnace casing by steel or iron anchor bolts approximately 3" in length, with no intermediate layer of insulation between the rear face of the brick and the steel casing, or, at best a very thin or narrow one. However, present marine and naval boiler furnace walls are constructed of a 4½" layer of firebrick, a 2½" layer of insulating material capable of resisting high temperatures, and a 1" layer of low temperature insulation, all held together and to the furnace casing by anchor bolts about 7" long. This arrangement causes the anchor bolts to be subjected to much higher temperatures than in prior years, because of the heat damming effect of the insulation layers which have become essential at the high heat releases and furnace temperatures presently employed. The high temperatures to which the anchor bolts are subjected have required the use of expensive alloys such as manganese-nickel and the like for these bolts. These high priced heat resistant bolts however, are subjected to heavy shearing stresses by the movement of the furnace lining with changing temperature, and to excessive strain through movements of the boiler casings, and in marine installations to the roll and pitch of the ship. In consequence, anchor bolt replacements have become an item warranting serious attention. In spite of the high quality of the anchor bolt material, losses have become excessive, primarily because of the lengths of the anchor bolts employed, and secondarily because of the high temperatures to which they are subjected. Manifestly, a short anchor bolt can withstand more service and will cost less than a longer one, even when both are subjected to the same temperature; but a shorter bolt, if utilizable, would be subjected to a lower temperature since it could be located farther from the hot face of the refractory.

The present invention overcomes these disadvantages of prior practice and provides a furnace lining block comprising a relatively thin layer, about 2" in thickness, and of square, rectangular, hexagonal or other configuration, of highly refractory material such as zirconite, sillimanite, mullite, or any other highly heat resistant mineral or compound, having a projection of rectangular, circular, or any other cross-sectional configuration, extending from its rear face or surface toward the furnace casing. This projection or "spud," may be cast, pressed, or otherwise formed integrally with and of the same substance as the fire face of the lining block, but it may be separately manufactured and bonded to the rear face of the block. The outer end of the projection is provided with a recess, keyway or other device, by which a very short hooked end or flat-headed anchor bolt can engage the block and hold it to the furnace casing. The refractory projection by which the short anchor bolt is made utilizable may be located at or near the center of the block, or it may be located at any other suitable position thereon. The invention also contemplates the use of such layers of thin insulating brick, high intermediate temperature insulation, or both, and low temperature insulation, as may be required between the rear face of the high temperature refractory layer at the fire face of the furnace wall and the end of the refractory projection, each of these thin blocks or laminations being furnished with a hole at the center, edge, or other position, to permit each lamination to be passed over or around the projection by which the whole block is held to the casing by the short anchor bolt. Through careful selection of the layers of heat resistant materials the thickness and weight of refractory furnace linings may be appreciably decreased. This is of particular value in naval boiler furnace construction. The layers of heat resistant and insulating materials utilized, may be securely bonded to each other and to the refractory facing and its projection by the use of fire clay, or preferably, special high temperature, high bonding strength cement, the assembly forming a single furnace lining block. The bonding of the block may be accomplished at the plant where it is manufactured, or the various layers may be dipped in suitable cement individually and the block assembled in the boiler furnace immediately prior to laying up the furnace wall. In the latter instance, the necessary bonding is accomplished in the presence of heat from the furnace, which should be

lighted off as soon as practicable after the wall is laid up.

The invention will be understood from the following description when considered in connection with the accompanying drawings forming a part thereof and in which:

Fig. 1 is an isometric view of a portion of a furnace wall embodying the invention;

Fig. 2 is a sectional view on an enlarged scale, taken on line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a perspective view, on an enlarged scale, of the furnace lining block shown in Figs. 1, 2 and 3;

Figs. 5, 6 and 7 are perspective views, on an enlarged scale, of the insulating layers of the block shown in Figs. 1, 2 and 3 respectively;

Fig. 8 is a sectional view similar to Fig. 2, but showing another form of anchor bolt, and

Fig. 9 is a sectional view taken on line 9—9 of Fig. 8.

Like characters of reference refer to the same or to similar parts throughout the several views.

Referring to the drawings, reference character 10 designates the metal casing of a boiler furnace having a lining embodying the invention. As shown, the lining comprises a plurality of blocks of substantially cubical configuration, each of which consists of a plurality of relatively thin laminations constructed and assembled in accordance with the invention. In the form of the invention illustrated, each block has four laminations, but the invention contemplates the use of two or more laminations and is not restricted to any particular number thereof. The fire face refractory lamination 11 is approximately square and has a projection 12 integral therewith or bonded thereto, which is of substantially smaller cross-sectional area than the laminations and extends from the central portion of the rear face thereof. The projection 12 may be of the same material as the lamination 11 or of other suitable material. The intermediate insulating laminations 13 and 14 and the rear laminations 15 are of the same size as the lamination 11 but are of different thicknesses, and each is provided with a central opening 16 which is slightly larger than the projection 12. The axial length of the projection 12 is approximately equal to the total thickness of the insulating laminations 13, 14 and 15. The laminations are securely bonded together and the insulating laminations are bonded to the projection 12 as previously mentioned.

With this block arrangement, short anchor bolts may be utilized to hold the blocks to the furnace casing. The rear end portion of the projection 12 is formed to receive the inner end of the anchor bolt. With the form of anchor bolt 27 shown in Figs. 1 to 3, having a square head 17 and a laterally extending end portion 18, the projection has an L-shaped slot 19 opening into the lower and rear faces of the projection, the dimensions of which are large enough to receive freely the head 17 of the bolt, and a connecting slot 20 which is wide enough to receive freely the shank of the bolt. With this arrangement, when the bolt is positioned in the slot as shown in Figs. 2 and 3, the bolt head will engage the walls of the slot and will retain the block in position. Since the only way the block can be removed from the anchor bolt is by raising the block the considerable distance necessary to cause it to clear the head or inner extension thereof, it will be perceived there is little likelihood that the blocks will become loose in service. End portion 18 of the bolt is received in a clip 21 which is welded to the casing 10. Inasmuch as the bolt is required to extend only from the casing 10 to the rear portion of the projection 12, a very short bolt will suffice.

With the form of anchor bolt 22 shown in Figs. 8 and 9, having a laterally extending portion 23 at one end and a portion 24 extending laterally in the opposite direction at the other end, the rear end portion of the projection 12 is formed to provide an L-shaped slot 25 the dimensions of which are sufficient to receive one end portion of the bolt 22. Any other suitable form of anchoring means may be used.

As an example of the materials which are suitable for the several laminations of the form of block shown, the fire face lamination 11 may be made of the highly refractory material heretofore mentioned, lamination 13 may be made of a refractory or insulating material, or both, such as Armstrong EF 26, lamination 14 may be of insulating material of high heat damming quality such as Armstrong C 22, and lamination 15 may be made of insulating material such as Sil-O-Cel. Other minerals, ores or compounds may be substituted for the materials mentioned to meet the requirements for individual installations.

As an example of the dimensions of the several parts, or the laminations, of the block illustrated, the fire face lamination 11 may be 9" by 9" by 2" thick, with the projection 3" by 3" by 5" long. Each of the laminations 13, 14 and 15 will be 9" by 9" with lamination 13 being 1½" thick, lamination 14 being 2½" thick, and lamination 15 being 1" thick. With these proportions, the overall dimensions of the block will be 9" by 9" by 7".

Inasmuch as changes may be made in the form, location and relative arrangement of the several parts of the block disclosed and in the anchoring means as well as in the material of the several laminations of the block without departing from the principles of the invention, it will be understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. A furnace lining block comprising a plurality of laminations one of which has a portion which extends through at least one other lamination.

2. A furnace lining block comprising a plurality of laminations, the fire face lamination having a projection which extends through at least one other lamination.

3. A furnace lining block comprising a plurality of laminations, the fire face lamination having a projection which extends through the other laminations, the outer end portion of the projection being formed to receive block anchoring means.

4. A furnace lining block part comprising a fire face lamination and a projection extending from the face of the lamination which is opposite the fire face, and means associated with the outer end portion of the projection arranged to receive block anchoring means.

5. A furnace lining block comprising a fire face section having a projection extending from the face of the section which is opposite the fire face, and at least one other section having an aperture through which the projection extends.

6. A furnace lining block comprising a fire face section having a projection extending from the

face of the section which is opposite the fire face, and at least one other section having an aperture through which the projection extends, the outer end portion of the projection being formed to receive block anchoring means.

7. A furnace lining block comprising a fire face section having a projection extending from the face of the section which is opposite the fire face, and at least one other section having an aperture through which the projection extends, the several sections being bonded together.

8. A furnace lining block comprising a fire face section having a projection of substantially the same material as the section and extending from the face of the section which is opposite the fire face, and at least one other section having an aperture through which the projection extends.

9. A furnace wall including a casing, a lining therefor comprising a plurality of blocks each having a fire face section provided with a projection of substantially the same material as the section, and at least one other section having an aperture through which the projection extends, and block anchoring means extending between the outer end portion of the projection and the casing.

10. A furnace wall including a casing, and a lining therefor comprising a plurality of blocks each having a fire face section provided with a projection of substantially the same material as the section, and at least one other section having an aperture through which the projection extends, the outer end portion of each projection having a recess formed to receive an end of an anchor bolt, the other end of which is secured to the casing.

11. A furnace lining block comprising a fire face section having a projection extending substantially normally from the face of the section which is opposite the fire face, and at least one other section having a periphery of substantially the same shape and size as the fire face section and having an aperture through which said projection extends, the outer end portion of the projection being formed to receive block anchoring means.

12. A furnace lining block comprising a fire face section having a projection extending substantially normally from the face of the section which is opposite the fire face, and a plurality of other sections each having a periphery of substantially the same shape and size as the fire face section and having an aperture through which said projection extends, the sum of the thicknesses of the other sections being equal substantially to the length of the projection, the outer end portion of the projection being formed to receive block anchoring means.

13. A furnace lining block comprising a fire face section of refractory material having a projection of essentially the same material extending substantially normally from the face of the section which is opposite the fire face, and at least one other section of heat insulating material having a periphery of substantially the same shape and size as the fire face section and having an aperture through which said projection extends, the outer end portion of the projection being formed to receive block anchoring means.

14. A furnace lining block comprising a fire face section of substantially rectangular configuration having a projection of substantially rectangular transverse cross-sectional configuration and smaller than said section extending from the face of the section which is opposite the fire face, and at least one other section having a periphery of substantially the same shape and size as the fire face section and having a substantially rectangular aperture slightly larger than the projection through which the projection extends, the outer end portion of the projection being formed to receive block anchoring means.

ALBERT P. SHORT.