June 15, 1943. J. H. HENZEL 2,321,813

REFRACTORY PANEL CONSTRUCTION

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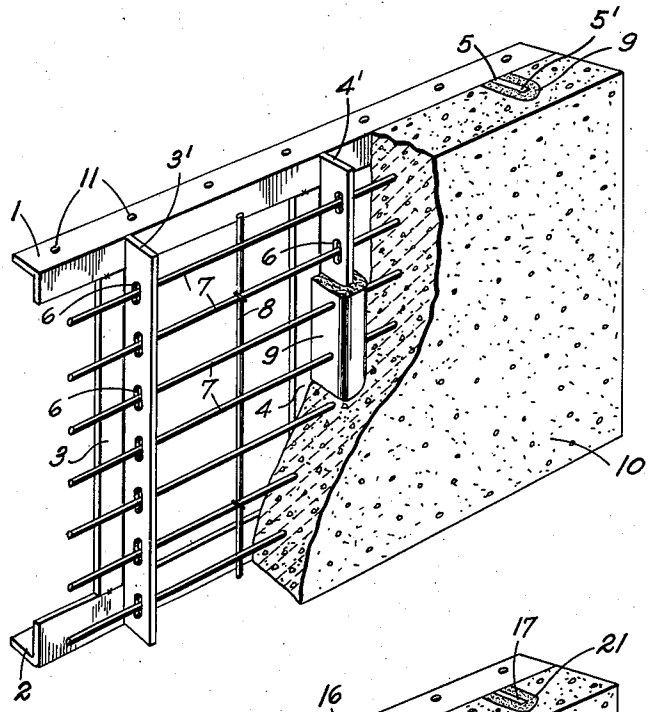

Fig. 1

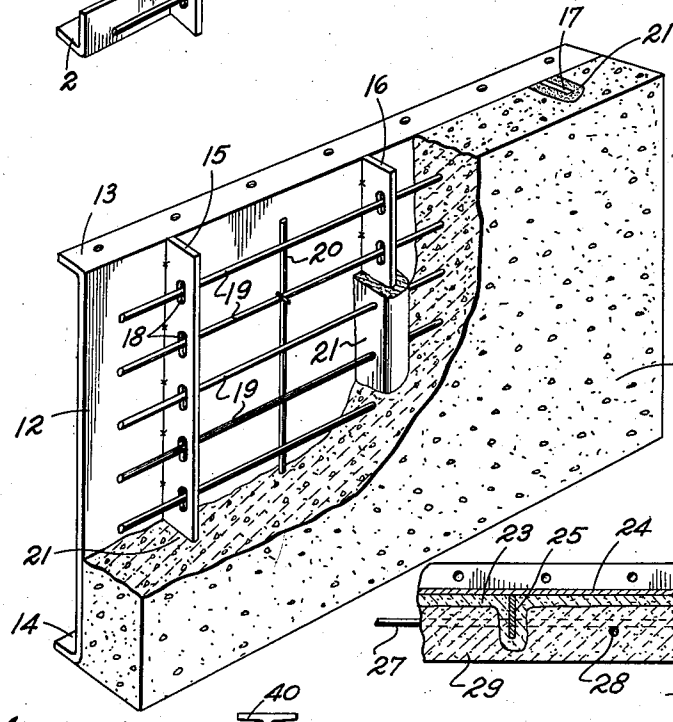

Fig. 2

Fig. 3

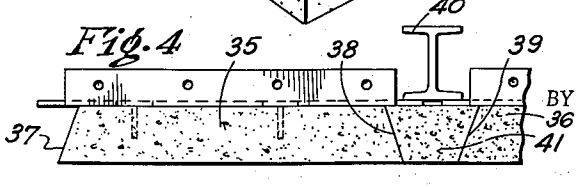

Fig. 4

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REFRACTORY PANEL CONSTRUCTION

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7 Claims. (Cl. 72—101)

This invention relates to wall panel construction and more particularly to an improved refractory panel unit for combustion furnaces or the like.

The walls of combustion chambers and heating sections or zones of certain types of boilers, heat treating and other furnaces may conveniently and advantageously be built up from prefabricated panel units of relatively large sizes, for example approximately 4 feet by 6 feet. Such panel units may be manufactured in a factory and shipped in the desired sizes and quantities to the place where the furnace is to be erected. With this type of construction the necessity for providing and laying refractory bricks, or suspension of small special tiles, is eliminated and substantial economies of labor and material are obtained. The individual panel units may, with or without special fillers, be arranged to form the side walls, roof and floor of the furnace or heater and are supported in position by securing them to a suitable outer frame structure.

It is among the objects of the present invention to provide a refractory panel unit which is strong, rugged, and economical to manufacture, and which will withstand temperatures and temperature variations within the range of the refractory without failure. Other objects of my invention include the provision of a refractory panel construction in which a metal sheet of a gauge or thickness substantially equal to that ordinarily used for casing only, is so reinforced by means of flanges and ribs angularly disposed to each other, in combination with additional reinforcing rods or wires, that a refractory body is so supported by said ribs and rods that it is free to expand or contract volumetrically, laterally, longitudinally, and transversely without danger of cracking or breaking loose and falling away from the supporting frame; the provision of a refractory panel which has sufficient rigidity to permit shipping and handling prior to and during installation, and which may or may not be supplied with a metal plate forming the outside surface of the panel; and the provision of a refractory panel employing a castable refractory and having heat insulating material interposed between the refractory cement body and the metal structure of the panel whereby heat transfer to the metal structure is retarded.

The above and other objects of my invention will appear from the following description of several embodiments thereof, reference made to the accompanying drawing in which:

Figure 1 is a perspective view of one of my panels, parts of the insulating and refractory materials being broken away more clearly to illustrate the arrangement.

Figure 2 is a view generally similar to Figure 1 but illustrating another embodiment of my invention which is particularly suited to form the walls of a furnace disposed where protection for the outer wall surface is desired.

Figure 3 is a fragmentary horizontal cross-sectional view of another embodiment of my invention showing a panel unit, generally similar to that illustrated in Figure 2, but having insulating material interposed between the refractory and the outer metal sheet.

Figure 4 is a cross-sectional view similar to Figure 3 but illustrating panels having beveled edges and filler blocks retained therebetween.

The panel unit shown in Figure 1 comprises a metal frame made up of spaced structural angles 1 and 2 connected by transversely extending structural T's 3, 4 and 5. These T's are preferably welded at their ends to the angles 1 and 2 and are provided with spaced, preferably elongated, holes 6 through which the longitudinally extending reinforcing rods 7 extend. After the rods 7 are inserted in position in these holes, transverse reinforcing rods 8 are supported preferably loose from but possibly wired to the rods 6 between the webs 3', 4' and 5' of the bars 3, 4 and 5.

Before or after, preferably before, the rods 7 are installed in the structural steel frame of the panel, insulating material such as mineral wool or vermiculite base insulating cement or other suitable resilient or yieldable material is placed over the outstanding legs 3', 4' and 5' of the T members. The reinforcing rods 6 are conveniently retained in position during manufacture by the resilient insulating material 9. After this structure is built up, it may be placed in a suitable mold or casting box and the refractory body 10, in the form of a semi-fluid or plastic cement is then poured in so that it covers the supporting structure except for the angles 1 and 2. After the refractory cement has hardened and completely set, the finished panel is removed from the casting box and is then ready for use. The angles 1 and 2 are preferably provided with spaced holes 11 which facilitate bolting adjacent panels together or fastening the panels to a supporting frame work.

By forming the holes 6 as somewhat elongated slots and making them slightly larger than the diameter of the reinforcing rods 7, expansion and contraction of the rods relative to the T-bars 3,

4 and 5 may freely take place. In effect, the refractory mass or body 10, together with its reinforcing rods 7 and 8, forms a monolithic block which may expand and contract in all directions relative to the supporting frame structure. Such expansion and contraction is permitted because of the free passage of the bars 7 through the holes 6 and also because of the provision of the resilient or yieldable covering cushions 9. This yieldable material, preferably having heat insulating characteristics also, will be compressed to permit movement of the refractory material 10 relative to the ribs 3', 4' and 5' and thus any tendency of the refractory material to crack or be subjected to excessive stress due to temperature variations encountered in operation will be overcome.

The panel unit shown in Figure 2 is generally similar to that illustrated in Figure 1 except that a relatively thin sheet metal backing plate 12, provided with top and bottom flanges 13 and 14, is provided instead of the spaced angles 1 and 2. The term "thin" as used herein in referring to the backing plate or sheet is intended to mean not greater in thickness than 3/16" and preferably not greater than 1/8". Stiffening and reinforcing flanges or ribs 15, 16 and 17 are welded, or otherwise secured, to the plate 12 and are provided with holes 18 which correspond to the holes 6 in Figure 1. The reinforcing rods 19 and 20 are spaced from the plate 12 and positioned by passing through the holes 18. Resilient pads or cushion members 21 overlie the projecting ribs 15, 16 and 17. In order to cast the refractory body 22 onto the structure of Figure 2, it is only necessary to provide walls to retain the fluid or plastic cement in position until it has set. The metal plate 12 forms a solid, weatherproof back for the panel unit, and this form of my invention is particularly adapted for forming furnace walls which are exposed to the elements. No effort is made to bond the refractory body 22 to the backing plate 12 as the reinforcing rods 19 and the ribs 15, 16 and 17 provide the necessary support for the refractory body. Due to the resilient cushions 21, the refractory body 22 may expand or contract in any direction relative to the backing plate 12 and the ribs 15, 16 and 17 without cracking.

Figure 3 illustrates still another modification of my improved panel construction in which the yieldable insulating material 23 overlies the entire surface of the back plate 24 (which corresponds to plate 12 of Figure 2) and also overlies the ribs 25 and 26 (corresponding to ribs 15 and 16 of Figure 2). The reinforcing rods 27 and 28 and the refractory body 29 are substantially the same as the corresponding elements of the other forms of my invention. The insulating layer 23 is not necessarily bonded to the back plate 24 or to the ribs 25 and 26 but will be held in place by the refractory body 29. With this arrangement very effective heat insulation can be obtained, and in certain instances this arrangement may be preferable to those illustrated in Figures 1 and 2.

From the above description it will be observed that the supporting structure for my panels may be built up of structural steel angles and T's or by a metal sheet having projecting ribs secured thereto. In either arrangement the projecting ribs form flanges which may be used to retain insulating material such as a non-metallic, non-combustible sheet of asbestos and cement or other suitable composition.

In Figure 4 I have illustrated a horizontal cross-sectional view taken on a plane similar to that on which Figure 3 is taken, but showing an assembly of a pair of my panel units generally indicated at 35 and 36. These units differ from those illustrated in the other figures by having beveled edges as seen at 37, 38 and 39. The I-beam 40 is part of the supporting frame for the furnace structure and the panels 35 and 36 are secured thereto. In order to form a proper joint between the ends of the adjacent panels 35 and 36, I use refractory filler blocks 41 which are supported and held in position by the beveled edges 38 and 39 of the adjacent panels. This arrangement facilitates the formation of a tight joint between adjacent panels 35 and 36 and eliminates the necessity for separate support for the filler blocks 41.

It will be understood, however, that although I have illustrated and described in considerable detail several forms of my refractory panel construction, variations and modifications may be made in the arrangement and proportions of the parts without departing from the spirit of my invention, and I do not, therefore, wish to be limited to the particular constructions shown and described, but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. In a wall panel having a metal frame structure, a plurality of ribs each having spaced holes therein, reinforcing rods extending through and having a loose fit in said holes, coverings of yieldable material over said ribs, and a monolithic body surrounding said reinforcing rods and yieldable material.

2. In a wall panel having a metal frame structure, a rib projecting from said frame toward the inside surface of said panel, said rib having a hole therethrough, a reinforcing rod having a loose fit in said hole and extending substantially parallel to said inside surface of said panel, a covering of yieldable material over said rib, and a cast monolithic body of refractory material supported by said reinforcing rod and maintained out of engagement with said rib by said yieldable material.

3. A panel unit of the type described comprising a metal frame having a plurality of ribs extending outwardly therefrom, a monolithic refractory body, reinforcing rods extending through said body and moveably supported by said ribs, and yieldable covers of insulating material disposed between said refractory body and said ribs whereby limited relative movement between said body and frame may occur without cracking said body.

4. In a panel unit of the type described, a frame structure having a plurality of substantially parallel ribs extending across the frame and projecting outwardly therefrom, said ribs each having a plurality of elongated holes therethrough, reinforcing rods extending through said holes and having a loose sliding fit therein, yieldable insulating covers for said ribs, and a refractory body surrounding said reinforcing rods and covering said insulating covers, said refractory body and reinforcing rods being supported by said frame whereby limited relative movement due to differences in expansion and contraction may occur between said frame and body without imposing harmful stresses on said body.

5. A panel unit having a sheet metal backing

plate forming the outer surface of the panel, a plurality of ribs secured to and extending across said plate and projecting toward the inside of the panel, a monolithic body covering the inner face of said plate and having metal reinforcing rods therein, said rods being supported by said ribs for limited movement relative thereto, and yieldable insulating material disposed between said monolithic body and said ribs.

6. A panel unit having a sheet metal backing plate forming the outer surface of the panel, a plurality of ribs secured to and extending across said plate and projecting toward the inside of the panel, a monolithic body having metal reinforcing rods therein, said rods being supported by said ribs for limited movement relative thereto, and a layer of yieldable insulating material disposed between said monolithic body and said ribs and backing plate.

7. A panel unit of the type described comprising a thin sheet metal plate having a plurality of substantially parallel stiffening and reinforcing ribs, reinforcing rods retained in position by said ribs and spaced from said metal plate, a refractory body surrounding said reinforcing rods and substantially surrounding said ribs and being thereby secured to and extending parallel with said plate, said refractory body being free to move limited distances in all directions except toward said plate.

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