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CONSTRUCTION OF HEATERS

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FIG. 1

FIG. 2

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The invention, particularly refers to an improved and relatively inexpensive type of wall construction for furnaces, heaters and the like, to the prefabricated slabs or sections from which said wall is formed and to the method of manufacturing said slabs.

The conventional method of constructing large industrial heaters is to lay up a wall of refractory shapes, such as fire-brick, in fire-clay mortar or furnace cement and to provide a steel framework outside the refractory walls which act as a supporting structure for the roof of the heater and as buckstays to prevent bulging of the walls. Ordinarily, it is necessary to provide insulation between the masonry and the steel structure and, in most cases, particularly when the heater is intended for outdoor use, a metal housing or sheath of weather-resistant material is attached outside the steel framework.

The present invention obviates this relatively expensive type of construction, particularly where exceptionally high temperatures are not encountered in the walls of the heater, by combining a refractory lining, insulating material and metal sheathing in a single prefabricated slab or wall section which may be easily and quickly erected and anchored to a structural steel framework.

The slabs or unit sections of the wall comprise a substantial thickness of insulating material, to one surface of which a plastic refractory or semi-refractory material is directly applied, the opposite surface of the insulating material being backed by a relatively light gauge metal plate or sheet. The inner side of the metal sheet is provided with suitable protrusions or lugs, formed from the sheet itself and integral therewith or attached to the inner surface of the sheet, which extend a short distance into the insulating material and anchor the same in place on the sheet. The outer face of the sheet is likewise provided with protrusions or clips integral with or attached to the sheet which serve as a means of anchoring the prefabricated wall sections to a structural framework provided on the outer side of said walls.

In constructing the prefabricated wall sections or slabs, the required protrusions are first punched from the metal sheet or the lugs and clips are attached thereto by welding or in any other desired manner, following which a substantial thickness of insulating material is applied to the inner face of the sheet in plastic state. The coating or layer of refractory or semi-refractory material is applied to the exposed surface of the insulating material in plastic state, preferably after the insulating material has partially dried or set. Both the insulating material and refractory material may then be allowed to thoroughly dry and cure or, preferably, is placed in an oven wherein a mild temperature is first employed to thoroughly dry the plastic materials, following which the refractory surface is heated to a high temperature to glaze the surface. The slabs in unit sections are ready for erection upon cooling and may be employed as the side walls or roof of the heater, or both.

Any type of refractory or semi-refractory material which may be applied in plastic state and is capable of withstanding the temperature conditions to which it is exposed may be employed within the scope of the invention and the insulating material employed may also be of any type which may be applied in plastic state and will harden into a relatively rigid slab and protect the metal sheet to which it is applied against excessive temperatures. Preferably, the insulating material is applied in sufficient thickness to provide one to two inches, or more, of insulating material between the anchoring lugs or protrusions of the metal plate and the heated surface of the slab and sufficiently thick to prevent the excessive loss of heat by radiation through the walls. The thickness required will, of course, vary with different types of insulating material and different furnace conditions and the type of insulating and refractory materials employed, as well as the thickness of each, may be selected to suit requirements. The size of the individual slabs or sections is preferably such that they may be readily handled and installed by manual labor and the optimum size will, of course, vary with their thickness and with different unit weights of the materials which comprise the slab.

In the accompanying diagrammatic drawings, Figure 1 is a cross-sectional elevation of a portion of a heater employing prefabricated slabs or sections of the type herein provided for both side walls and roof and constructed in accordance with the features of the invention. Figure 2 is a longitudinal section of a portion of the side wall of the same heater taken along the plane indicated by line 2—2 in Figure 1. Figures 3, 4, 5 and 6 are, respectively, front, back, end and side views of one specific form of prefabricated slab or wall section of the type herein provided. Figure 7 is a detail of a portion of the metal plate which forms the back of the slab shown in Figures 3 to 6 inclusive, illustrating one specific form of protruding lug punched from the stock.
of said metal plate and spaced clips also punched from the metal plate for attaching the same to the structural framework of the heater. Figure 8 illustrates another specific form of protruding lug which may be punched from the metal plate.

Figure 9 is a detail of a portion of a modified form of metal plate which may be employed as a back for the furnace slab and Figure 10 illustrates a portion of another modified form of plate which may be employed.

Referring particularly to Figures 1 and 2, the furnace structure here illustrated comprises a suitable foundation 1 and upright structural beams 2 anchored to the foundation by bolts 3 which pass through plate 4, the latter being welded or attached in any other desired manner to the bottom of member 2. Substantially horizontal beams 5 are attached to the upper ends of members 2 by welding or any other desired manner to form the supporting framework or the roof of the structure. Additional metal members, such as angle 6, may be provided for transfer brackets between the main frame of the members 2 and the diagonal braces, not illustrated, may be provided, as required, and attached to the main framing members in any conventional manner.

The prefabricated slabs or wall sections 7, of which the walls and roof of the heater are formed, have protruding clips 8 punched from the stock of metal sheet 9 adjacent its edges and horizontally disposed metal members such as T bars 10 are provided at spaced intervals, corresponding to the height of slab 7, with which clips 8 are engaged in the manner illustrated. T bars 10 are, in turn, attached to the flanges of beams 2 and 5 by means of suitable metal clips 11 bolted, as indicated, to the lug of each of the T bars. This clip construction permits adjustment of the spacing between the T bars to accommodate the height of slabs 7 but, when desired, the T bars may be rigidly attached to members 2 and 5 by welding or any other conventional manner.

In the particular case here illustrated, a bar channel 12 is provided at the lower end of members 2 to receive the bottom clip 8 of the lowermost wall slab, this channel being attached to members 2 or anchored to the foundation in any conventional manner.

Preferably, the metal plate of all corner slabs is brought over the exposed edges of the slab, as indicated at 14, so that the protective metal shingling of the walls is continuous and, as indicated at 14, the adjacent edges of the slab are preferably relieved to provide a space therebetween which may be partially filled with insulating and sealed with suitable cementitious refractory material.

Similar slabs laid on structural metal members anchored to the foundation are attached to members 2 which may be provided for the floor of the heater but, preferably, as in the case here illustrated, a sub-floor 15 of reinforced concrete or the like is provided over which preformed slabs 16 of suitable insulating material surfaced with plastic refractory material are laid or a similar floor may be poured in place.

Referring now particularly to Figures 3 to 6 inclusive and also to Figures 1 and 2, the metal plate 9 of the prefabricated individual wall sections or slabs is provided with protruding lugs 17 (see also Figure 7) punched from the plate and extending into the insulating material 18 which is poured or cast in plastic state over the surface of the plate from which these lugs project, the lugs 17 serving to anchor the insulating material to plate 9. The surface layer or coating 19 of refractory material is applied in plastic state over the exposed surface of the insulating material.

The clips 8 are punched from the edges of plate 9 in a direction opposite to that of lugs 17 at spaced intervals or, when desired, the plate may be deformed along its edges as shown at 23 in Fig. 9 to provide a continuous clip.

In Fig. 9 the metal sheet or plate is designated as 20B and, in the particular case here illustrated, the clips 23 and the protruding members 24, which anchor the insulating material to the plate, are continuous. Members 24, as here shown, have spaced Z bars welded or attached to the plate 30C in any other conventional manner.

It is also within the scope of the invention to provide clips and lugs such as indicated, for example, at 20 and 21, respectively, in Figure 10 which are welded or may be otherwise attached to opposite sides of the metal plate or sheet 30C in any conventional manner.

The type of construction shown in Fig. 9 or in Fig. 10 is preferred when the insulating material employed in the slabs is not weather-resistant or is excessively hygroscopic, in order to prevent weathering of the slabs due to the insulation which is exposed when the lugs and clips are punched from the plate.

Another more simple form of punched lug, which is satisfactory with some of the more rigid types of insulating material is indicated at 22 in Figure 8, the metal plate, corresponding to plate 30, Figs. 1 to 7 inclusive, being here designated as 30A.

It will, of course, be understood that various other combinations of the specific forms of clips and protruding members illustrated may be employed without departing from the scope of the invention and that the invention is not limited to the specific form of these members here illustrated and described since many other satisfactory forms will be apparent from the teachings of the invention.

I claim as my invention:

1. A furnace wall comprising, in combination, spaced main framing members, auxiliary members attached to said main framing members and preformed sections of wall material retained in place by said auxiliary members, said preformed sections comprising a substantial thickness of insulating material, a thinner layer of refractory material applied directly and bonded to one face of the insulating material, and a relatively rigid metal sheet on the opposite face of said insulating material, said sheet being provided with spaced protruding members which extend part way into the insulating material and anchor the same to the sheet and also being provided with clips adjacent opposite edges thereof which attach said section to said auxiliary members a portion of said protruding members being substantially parallel to said metal sheet.

2. A furnace wall comprising, in combination, spaced upright columns anchored to a foundation, auxiliary members disposed transverse to said columns on one side of the latter and attached to the columns, metal plates which form a substantially continuous wall surface on the opposite side of said auxiliary members from the columns and attached to said auxiliary members by clips disposed along edge portions of said sheets, a substantial thickness of insulating material covering the face of said sheets opposite
said auxiliary members and anchored to said sheets by spaced members provided on the latter which protrude into and are covered by the insulating material the said spaced members being disposed at an angle to said sheets, and a thinner layer of refractory material applied directly and bonded to the face of said insulating material opposite said sheets.

3. A furnace wall comprising, in combination, upright flanged metal columns spaced apart and anchored to a foundation, auxiliary members extending transverse to and secured to said columns and on one side of the latter by means of metal clips movably engaging adjacent flanges of the column, metal plates which form a substantially continuous wall surface on the opposite side of said auxiliary members from the columns and attached to said auxiliary members by clips disposed along edge portions of said sheets, a substantial thickness of insulating material covering the face of said sheets opposite said auxiliary members and anchored to said sheets by spaced members provided on the latter which protrude into and are covered by the insulating material said spaced members being at an angle to said sheets, and a thinner layer of refractory material applied directly and bonded to the face of said insulating material opposite said sheets.

4. A furnace roof comprising, in combination, spaced metal beams, auxiliary metal members disposed transversely to said beams, metal sheets disposed beneath and attached to said auxiliary members by means of clips disposed along edge portions of the sheets, a substantial thickness of insulating material covering the under-face of said sheets and anchored thereto by members protruding from the sheets and at an angle thereto into the insulating material and covered by the latter and a thinner layer of refractory material applied directly and bonded to the under-surface of said insulating material.

5. A furnace roof comprising, in combination, flanged metal beams spaced apart and secured to upright metal framing members, auxiliary metal members disposed transverse to and attached to the beams beneath the latter by clips which movably engage the adjacent flanges of the beam, metal plates disposed beneath and attached to said auxiliary members by clips disposed along edges of the sheets, a substantial thickness of insulating material covering the under-face of said sheets and anchored to the latter by means of members protruding from said under-face of the sheets and at an angle thereto into the insulating material and a thinner layer of refractory material applied directly over the under-surface of said insulating material and bonded thereto.

6. A furnace wall comprising in combination, spaced main framing members, preformed sections of wall material forming a continuous wall on one side of and adjacent said framing members, said preformed sections comprising a substantial thickness of insulating material, a thinner layer of refractory material covering one face of and bonded to the insulating material and a perforate metal sheet anchored to said insulating material adjacent its opposite face by means of spaced members integral therewith and extending from the plane of the sheet part way into the insulating material, portions of said anchoring members being disposed at an angle to said plane of the sheet, and auxiliary connecting members including spaced clips disposed adjacent edge portions of the preformed sections for securing the same to said main framing members.

7. A furnace roof comprising in combination, spaced metal beams, auxiliary metal members disposed transversely to said beams, preformed sections of roofing material forming a continuous roof on one side of and adjacent to said auxiliary metal members, said preformed sections comprising a substantial thickness of insulating material, a thinner layer of refractory material covering one face and bonded to the insulating material and a perforate metal sheet anchored to said insulating material adjacent its opposite face by means of spaced members integral therewith and extending from the plane of the sheet part way into the insulating material, portions of said anchoring members being disposed at an angle to said plane of the sheet, and auxiliary connecting members including spaced clips disposed adjacent edge portions of the preformed sections for securing the same to said auxiliary members.

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