July 10, 1951 J. C. S. GINDER ET AL 2,559,763

PROTECTIVE COVERING FOR BLAST FURNACE BELLS

Filed Aug. 12, 1949

FIG. 1.

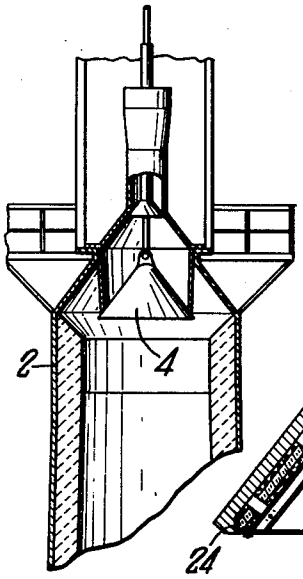


FIG. 2.

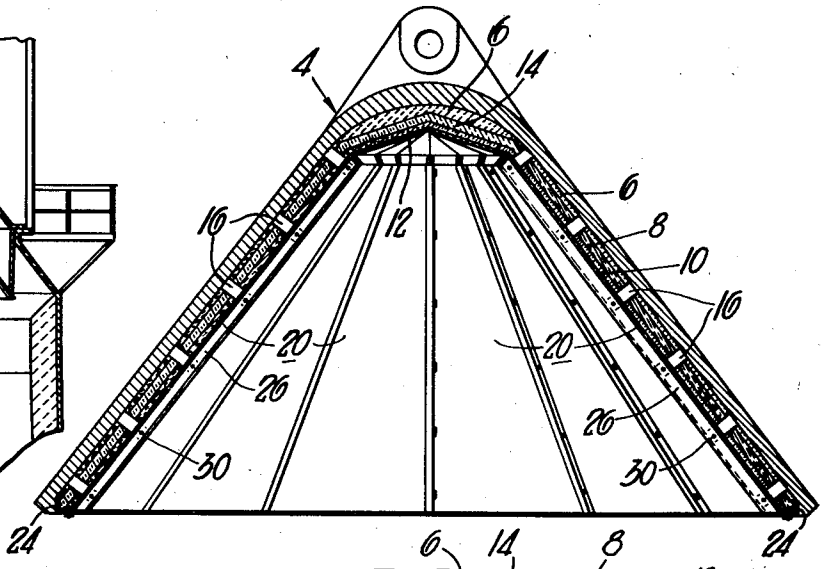


FIG. 3.

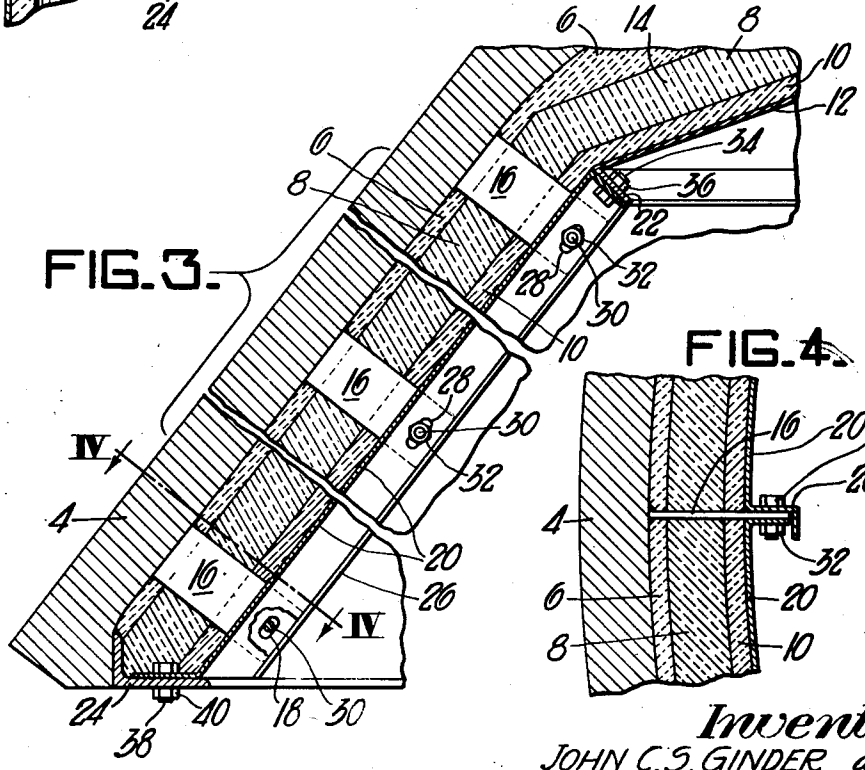


FIG. 4.

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PROTECTIVE COVERING FOR BLAST FURNACE BELLS

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7 Claims. (Cl. 266—27)

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This invention relates to blast furnace bells and more particularly to a protective covering therefor.

A double bell and hopper arrangement, well known to those versed in the art, is provided in the top of a conventional blast furnace to permit charging of raw materials therein without loss of gas. The bottom and larger bell of this unit is usually a thick steel casting. The massive structure of the bell is necessitated by the fact that it must withstand the temperature of the top furnace gas on the inside and the abrasive action of the raw materials being charged on its outer surfaces. The raw materials (ore, coke, limestone, etc.) slide over the outside surface of the bottom bell into the furnace. The bottom edge of the bell is machined so as to provide an effective gas seal with the hopper bottom.

In the modern blast furnace, the outside or top surface of the large bell is subjected to the temperature of the raw material being charged in the furnace, which temperature varies from 30° to 70° F.; while the inside surface of the bell is exposed to the temperature of the top gas of the furnace, which is approximately 400° F. when the furnace is producing basic iron. This top furnace gas temperature increases to a range of 800° to 1200° F. when the furnace is producing ferro-manganese or other ferro-metals. This difference in surface temperatures, particularly when the furnace is producing ferro-alloy metals, often cracks or warps the bell beyond repair necessitating its immediate replacement to maintain efficient operation of the blast furnace. In order to overcome this inherent defect, we propose to minimize the above described temperature differential by providing a protective insulating covering on the interior of the bell.

It is, accordingly, an object of our invention to provide a protective covering for the inner surfaces of a blast furnace bell which is rugged in construction, inexpensive to manufacture, and easy to install.

It is a further object of our invention to provide the inner surfaces of the large bell of a blast furnace with a protective covering including heat insulating means, metallic retaining means for protecting the insulation and holding it in position, and means for securing the protective cover to the bell.

These and other objects will be more apparent after referring to the following specification and attached drawings in which:

Figure 1 is a schematic view of the top portion of a blast furnace showing the double bell and hopper arrangement thereof;

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Figure 2 is a vertical sectional view of a large blast furnace bell having the protective covering of our invention installed;

Figure 3 is an enlarged sectional view of one wall of the bell shown in Figure 2; and

Figure 4 is a cross sectional view taken on the line IV—IV of Figure 3.

Referring more particularly to the drawings, reference numeral 2 indicates a typical modern blast furnace having installed in the top thereof a double bell and hopper arrangement for the charging of raw materials into the furnace. Reference numeral 4 indicates the bottom or large bell of the arrangement. The furnace and its double bell and hopper arrangement are of conventional construction except for the protective covering provided on the interior of the large bell 4, which is the subject of our invention and which will now be described.

The protective covering for the inside of the bell consists initially of a layer of refractory cement 6 applied to the inner surfaces of the bell. A layer of block insulating material 8 lies adjacent the refractory cement and a layer of fibrous insulating material 10 is disposed over the layer of block insulation. Any type material may be used for the block and the fibrous forms of insulation which will provide insulating properties up to approximately 1200° F. For the blocks, we have found it suitable to use an asbestos base insulation, such as "Superex," and for the fibrous material we have found fibrous asbestos to be satisfactory. While we have found it preferable to utilize three layers of insulating material, as described, it will be noted that a single layer or other combinations of insulating material could be used.

A special top portion 12 is provided to fit up against the insulating material in the crown of the bell as at 14. As shown in Figures 2 and 3, the insulation in the crown of the bell is a continuation of the layers covering the inner side walls. This top portion 12 is made of heat-resistant metallic sheet material, such as stainless steel, shaped to fit in the crown of the bell. A plurality of fasteners 16 is welded or otherwise attached to the inner surfaces of the bell. The fasteners project outwardly and are spaced so as to define several aligned vertical rows on the inside walls of the bell. The fasteners are in the form of relatively thin metallic plates, each having an elongated bolt hole 18 through the top portion thereof.

A plurality of trapezoidal retaining sheets 20 is positioned lengthwise between a lower flanged edge 22 of the top portion 12 and an inturned

circular angle member 24 which is attached, by welding or otherwise, to the inner periphery of the bell mouth. The sheets 20 are made of a heat-resistant material, preferably stainless steel. Frequently, the bell 4 is cast with an inturned lip around the periphery of its mouth. In such a case, it is, of course, unnecessary to provide the angle member 24 thereon.

The sheets 20 are disposed on the fibrous layer of insulating material 10 so as to retain all three layers of insulation in proper position. The sheets are provided with four flanged edges. One side edge 26 of each sheet has an overlapping portion, as shown in Figure 4. A plurality of spaced elongated bolt holes 28 is provided in each of the flanged edges. The retaining sheets are so positioned that the overlapped edge of one sheet lies next to a non-overlapped edge of the adjacent sheet with a row of fasteners 16 therebetween so that the elongated bolt holes 28 are aligned with the bolt holes 18 in the fasteners. A bolt 30 with a nut 32 threaded on its end clamps the retaining sheets to the fasteners. Bolts 34 and nuts 36 attach one end of the sheets to top portion 12 and bolts 38 and nuts 40 clamp the bottom flanged edges of the sheets to the circular angle member 24, as shown in Figure 3. Elongated bolt holes are also provided in the flanged lower edge of top portion 12 and in the angle member 24 for this purpose.

The method of installation of our protective covering is as follows:

Ring member 24 is welded to the inside periphery of the bell mouth. The fasteners 16 are welded onto the inner surfaces of the bell so as to define the positions for sheets 20. The layer of refractory cement 6 is then applied on the inner surface of the bell. The block insulation 8 is laid on the refractory cement and, in turn, the blocks 8 are covered by the layer of fibrous insulating material 10. The special top portion is fitted loosely in the crown of the bell and several of the retaining sheets 20 spaced intermittently around the periphery of the bell are put in position so as to support the top portion 12. Fibrous insulating material is then forced behind the special top portion 12 into the crown of the bell to insulate the same. Thereafter, the remainder of the retaining sheets 20 are bolted into position as described above. The bell is now ready for installation in the furnace.

The elongated bolt holes 18 and 28 permit unrestricted movement of the sheets 20 during expansion and contraction, both vertically and horizontally, without distortion.

To minimize direct heat transfer, the number of fasteners 16 is held to a minimum and they are made of thin metal. The retaining sheets 20 not only support and retain the insulation but they also form a protective covering for it against the particles of coke, etc., which may be thrown against the surface of the bell when the charge in the furnace slips.

Although we have found it preferable to use stainless steel for the retaining sheets 20, it will be noted that any heat-resisting material, such as nickel, would be satisfactory.

With our protective covering installed, the interior and exterior surface temperatures of the large bell will remain practically constant, thereby reducing to a minimum the tendency of the large thick casting to warp and crack or to become otherwise distorted when subjected to sudden change of furnace temperatures.

While one embodiment of our invention has been shown and described, it will be apparent

that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. Protective covering for a blast furnace bell comprising insulating means disposed on the inner surfaces of the bell, retaining means disposed adjacent said insulating means on the side thereof opposite the inner surfaces of the bell for holding said insulating means in position, said retaining means includng a top porton of heat-resistant metal in sheet form shaped to fit in the crown of the bell, and means for securing said retaining means to the inner surfaces of the bell.

2. Protective covering for a blast furnace bell comprising insulating means disposed on the inner surfaces of the bell, retaining means disposed adjacent the insulating means on the side thereof opposite the inner surfaces of the bell for holding said insulating means in position, said retaining means including a plurality of heat-resistant metallic sheets, and means for securing said sheets to the inner surfaces of the bell.

3. Protective covering for a blast furnace bell comprising a plurality of spaced fasteners in the form of metallic plates attached to and projecting from the inner surfaces of the bell, each of said fasteners having an elongated bolt hole through the upper portion thereof, insulating means disposed on the inner surfaces of the bell, and a layer of sheeting adjacent said insulating means on the side thereof opposite the inner surfaces of the bell for holding said insulating means in position, said sheeting layer including a plurality of separate heat-resistant metallic sheets having flanged edges, said flanged edges having a plurality of spaced elongated bolt holes therein, each sheet being adapted to be positioned so that the bolt holes in its flanged edges each lie adjacent a fastener hole, said sheets being joined together and secured to the inner surfaces of the bell by means of bolts inserted through the bolt holes in the flanged edges of the sheets and through the fastener hole adjacent thereto and nuts threaded on said bolts, the elongated bolt holes in said flanged edges and said fasteners permitting movement of said sheets when expanding and contracting.

4. Protective covering for a blast furnace bell comprising a plurality of spaced fasteners in the form of metallic plates attached to and projecting from the inner surfaces of the bell, each of said fasteners having an elongated bolt hole through the upper end thereof, insulating means disposed on the inner surfaces of the bell, retaining means for said insulating means including a top portion of heat-resistant metal in sheet form shaped to fit in the crown of the bell, and a layer of sheeting connected to and extending from said top portion to the periphery of the mouth of the bell adjacent the insulating means on the side thereof opposite the inner surfaces of the bell, said sheeting layer including a plurality of separate heat-resistant metallic trapezoidal sheets having flanged edges, said flanged edges having a plurality of spaced elongated bolt holes therein, each sheet being adapted to be positioned so that the bolt holes in its flanged edges each lie adjacent a fastener hole, said sheets being joined together and secured to the inner surfaces of the bell by means of bolts inserted through the bolt holes in the flanged edges of the sheets and through the fastener hole adjacent thereto and nuts threaded on said bolts, the elongated bolt holes in said flanged edges and said

fasteners permitting movement of said sheets when expanding and contracting.

5. Protective covering for a blast furnace bell comprising a plurality of spaced fasteners in the form of metallic plates attached to and projecting from the inner surfaces of the bell, each of said fasteners having an elongated bolt hole through the upper end thereof, insulating means disposed on the inner surfaces of the bell, said insulating means including a layer of refractory cement, a layer of block insulation disposed on said cement, and a layer of fibrous insulating material disposed on said block insulation, retaining means for said insulating means including a top portion of heat-resistant metal in sheet form shaped to fit in the crown of the bell, and a layer of sheeting connected to and extending from said top portion to the periphery of the mouth of the bell adjacent the insulating means on the side thereof opposite the inner surfaces of the bell, said sheeting layer including a plurality of separate heat-resistant metallic trazoidal sheets having flanged edges, said flanged edges having a plurality of spaced elongated bolt holes therein, each sheet being adapted to be positioned so that the bolt holes in its flanged edges each lie adjacent a fastener hole, said sheets being joined together and secured to the inner surfaces of the bell by means of bolts inserted through the bolt holes in the flanged edges of the sheets and through the fastener hole adjacent thereto and nuts threaded on said bolts, the elongated bolt holes in said flanged edges and said fasteners permitting movement of said sheets when expanding and contracting.

6. A blast furnace bell comprising an outer metallic shell forming a bell member, and a protective covering on the interior of said bell member, said protective covering including a plurality of spaced fasteners in the form of metallic plates attached to and projecting from the inner surfaces of the bell, each of said fasteners having an elongated bolt hole through the upper end thereof, insulating means disposed on the inner surfaces of the bell member, said insulating means including a layer of refractory cement, a layer of block insulation disposed on said cement, and a layer of fibrous insulating material disposed on said block insulation, retaining means for said insulating means including a top portion of heat-resistant metal in sheet form shaped to fit in the crown of the bell member, and a layer of sheeting connected to and extending from said top portion to the periphery of the mouth of the bell member adjacent the insulating means on the side thereof opposite the inner surfaces of the bell, said sheeting layer including a plurality of separate heat-resistant metallic trapezoidal sheets having flanged edges, said flanged edges having a plurality of spaced elongated bolt holes therein, each sheet being adapted to be positioned so that the bolt holes in its flanged edges each lie adjacent a fastener hole, said sheets being joined together and secured to the inner surfaces of the bell member by means of bolts inserted through the bolt holes in the flanged edges of the sheets and through the fastener hole adjacent thereto and nuts threaded on said bolts, the elongated bolt holes in said flanged edges and said fasteners permitting movement of said sheets when expanding and contracting.

7. Protective covering for a blast furnace bell comprising insulating means disposed on the inner surfaces of the bell, said insulating means including a layer of refractory cement, a layer of block insulation disposed on said cement, and a layer of fibrous insulating material disposed on said block insulation, retaining means adjacent said insulating means on the side thereof opposite the inner surfaces of the bell for holding said insulating means in position, and means for securing said retaining means to the inner surfaces of the bell.

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