

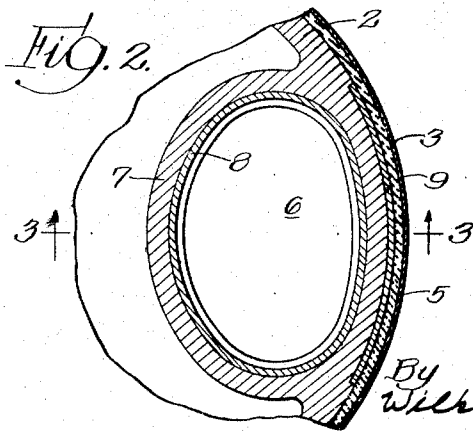
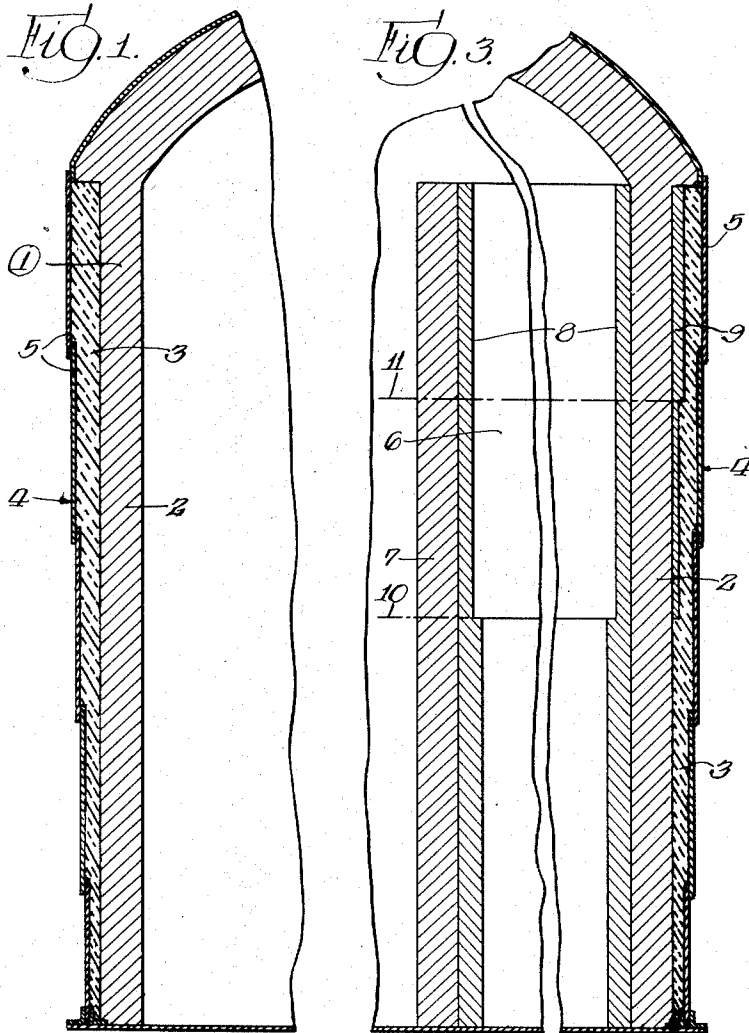
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BLAST FURNACE STOVE AND THE LIKE

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BLAST FURNACE STOVE AND THE LIKE

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The present invention relates to improvements in blast furnace stoves and the like.

Referring for the purpose of illustration to blast furnace stoves, it may be explained that such stoves are commonly of generally cylindrical design, the internal contour being uniform from top to bottom. This uniformity is desirable for the reason that such stoves are commonly filled with checkerbrick which expand and contract during the operation of the stove. By reason of this uniformity, vertical expansion and contraction are not interfered with. According to usual practice, a blast furnace stove is commonly enclosed within a steel shell. The heat transfer chamber of the stove is defined by a ring wall, commonly made up of fire-brick. Between the steel shell and the ring wall a layer of insulating material is provided. The temperature within the heat transfer chamber of a blast furnace stove is greater at the top than at the bottom of the stove, but, in spite of this fact, it has been common practice to provide a uniform thickness of the insulating material referred to from top to bottom of the stove, though in some instances the upper half of the ring wall has been decreased in thickness and an additional layer of insulating brick has been replaced between the fire-brick wall and the insulating material.

In the usual type of blast furnace stove, combustion takes place either in a central combustion chamber extending the height of the stove, or in a combination chamber disposed at one side of the stove. In either case the hot combustion gases pass up through the combustion chamber and return downwardly through the checkerbrick of the heat transfer chamber. Outlet to the stack is at the bottom of the stove. When the operation is reversed, the air to be heated enters the bottom of the stove, passes upwardly through the checkers in the heat transfer chamber and downwardly through the combustion chamber, thence out to the point of use.

The usual temperature gradient of the air to be heated is from approximately 100 degrees F. at the bottom of the stove to 1600 degrees F. at the outlet at the bottom of the combustion chamber. Referring to the stage of operation when hot products of combustion are directed through the stove, the temperature gradient which may be encountered is from approximately 2200 degrees F. in the combustion chamber to 300 degrees F. at the outlet. Accordingly there is a very material heat difference from the bottom to the top of the stove, and consequently, for efficient disposal of the insulating material, said insulating

material should not have uniform thickness throughout the height of the stove. In other words, according to general prior practice with which applicant is familiar, a large excess of insulating material has been used adjacent to the bottom of the stove, or, if that is not the case, an undesirable amount of radiation occurs in the upper section.

An object of the present invention is to provide a stove wall which with a minimum of material will preserve uniformity of heat insulating efficiency from top to bottom of the stove.

As a corollary to the above stated object, a further object is to provide an efficient wall structure for a hot blast stove or the like which is economical with respect to the material embodied in the steel shell. As another corollary to the above stated object, a further object is to provide an efficient wall structure with respect to the amount of insulating material required while providing a uniform internal diameter of ring wall.

A further object is to provide a wall structure for a hot blast stove, or the like, in which radiation loss will be substantially uniformly low throughout the height of the stove.

A further object is to provide a wall structure for a hot blast stove or the like in which the wall is decreased in diameter in close relationship to the temperature conditions throughout the height of the stove, to the end that the decrease in thickness of insulation from top to bottom resulting from the decreasing diameter of the shell is in substantial accord with the heat conditions at the various points throughout the height of the stove.

A further object is to provide a wall construction for hot blast stoves and the like which is well adapted to meet the needs of commercial operation.

Referring to the drawing—

Figure 1 is a fragmentary sectional view illustrating the structure of the wall of a blast furnace stove or the like, which wall may be used in connection with a stove having either a central combustion chamber or a side combustion chamber;

Figure 2 is a horizontal section of the structure of a hot blast stove or the like having a side combustion chamber; and

Figure 3 is a vertical sectional view taken along the plane indicated by the arrows 3—3 of Figure 2.

The numeral 1 indicates a stove wall, which may be of generally cylindrical contour, enclosing

a chamber which may be provided with heat exchanging checkers. The numeral 2 indicates a ring wall which may be built up of fire-brick. Exteriously of the ring wall 2 is a layer 3 of insulating material which is disposed between said ring wall 2 and the shell 4. The shell 4 is ordinarily of steel construction, and according to the present invention said shell is made up of a plurality of rings 5. The rings are cylindrical, and they vary in diameter to an extent such that the upper edge of each ring may be lapped within the lower edge of the adjacent ring thereabove. To this end the rings 5-5 are of progressively varying diameter from top to bottom of the wall 1. It will be clear, assuming uniform thickness of material of the rings 5-5, that the diameter of the steel shell is decreased at each step an amount equal to twice the thickness of the rings 5-5. Assuming a uniform external contour of the ring wall 2 from top to bottom (which is usual), the radial dimension of the annular space between the ring wall 2 and the outer shell diminishes from top to bottom of the stove wall. In other words, the radial dimension of the layer 3 of insulating material diminishes from top to bottom of the stove wall.

Figures 2 and 3 illustrate the construction adjacent to the combustion chamber of a hot blast stove wherein the combustion chamber is located at the side of the stove. In that case the ring wall 2 is formed to provide a chamber 6 extending throughout the height of the stove wall 1. To provide said chamber 6, the ring wall 2 is provided with the reversely arced portion 7. Said chamber 6 is provided with a curtain wall 8, which may be replaced from time to time, its purpose being to protect the material of the ring wall 2, including the portion 7 thereof, from the heat within the combustion chamber 6. Inasmuch as the temperatures within the combustion chamber 6 are higher than at corresponding heights in the remainder of the circumference of the furnace wall, an extra thickness of insulation is provided in the furnace wall adjacent to said combustion chamber 6. To this end the thickness of the layer 3 of relatively high-priced insulating material at the bottom of the furnace wall adjacent to the combustion chamber 6 may be considerably greater than the corresponding thickness at the diametrically opposed region of the furnace wall at the same height. The thickness of the layer of fire-brick 2 comprising the ring wall may also be greater in the portion of the furnace wall 1 adjacent to the combustion chamber 6. As distinguished from the variation in temperatures applied to the furnace wall throughout most of the circumference of said furnace wall, the temperatures in and adjacent to the combustion chamber 6 may be greater toward the bottom of said furnace chamber 6 than at the top thereof. At and adjacent to the top of the combustion chamber 6, temperatures are not greatly elevated above those at the same level in the remainder of the circumference of the furnace wall 1.

According to the practice which is at present preferred, the ring wall 2 in the region adjacent to the combustion chamber 6 is chosen of substantially uniform thickness from the bottom of the combustion chamber 6 to the top thereof. Inasmuch as the fire-brick comprising the ring wall 2 is relatively inexpensive and the insulating material comprised in the layer 3 is relatively expensive, it has been found desirable to insert in the segment of the furnace wall adjacent to

the combustion chamber 6 an intermediate layer of insulating brick, indicated by the numeral 9. Said insulating bricks are more efficient as heat insulators than are the fire-brick in the ring wall 2 and are correspondingly more expensive. However, said insulating bricks in the layer 9 are not so efficient nor so costly as the insulating material in the layer 3. In other words, the insulating properties of the insulating brick comprised in the layer 9 may be intermediate of the insulating properties of the fire-brick in ring wall 2 and those of the insulating layer 3, both in efficiency and in price. Accordingly, anyone skilled in the art can economically so balance the amounts of the relatively inexpensive fire-brick in the ring wall 2, the insulating brick of intermediate cost in the layer 9 and the insulating material in the layer 3 as to produce the result that the heat insulating effect of the furnace wall 1 adjacent to the combustion chamber 6 is varied throughout the height of the furnace wall to hold radiation loss per unit area to a uniform figure while maintaining a greater insulating effect in the stove wall adjacent to the combustion chamber 6 at a higher figure than at other portions of the circumference of the stove wall at corresponding levels.

Merely by way of example and not in a limiting sense, certain figures which are at present preferred may be recited, reference being had to a hot blast stove approximately 26 feet in diameter by 100 feet high. As noted above, the dimensions of the interior surface of the ring wall 2 including the portion 7 thereof are uniform from top to bottom of the stove. Inasmuch as said ring wall 2 is built up of fire-brick, it will be found convenient to have the thickness of said ring wall substantially uniform from top to bottom. Throughout most of the circumference of the furnace wall 1 said ring wall 2 may have a thickness of approximately 9 inches. In the portion of said ring wall which bounds the combustion chamber 6 said ring wall may have a thickness of about 13½ inches.

Throughout most of the circumference of the stove wall the thickness of the layer 3 may vary from about 7 inches at the top of the furnace down to about 1 inch at the bottom of the furnace, this variation in thickness being accomplished by the lapping of each of the rings 5 within the one above it. The curtain wall 8 may be stepped in thickness intermediate of the height of the combustion chamber 6. The thickness of said curtain wall up to the plane indicated by the numeral 10 may be approximately 6 inches. The thickness of said curtain wall above the plane 10 may be approximately 4½ inches. The layer 9 of insulating brick of intermediate cost and efficiency may start approximately at the plane 10 and extend up to the top of the stove wall. In order to reduce the cost of the relatively expensive insulating material comprised in the layer 3, the layer 9 may be stepped in thickness at approximately the plane indicated by the numeral 11. Between the plane 10 and the plane 11 said layer 9 may have a thickness of approximately 2 inches. Above the plane 11 said layer 9 may have a thickness of approximately 4½ inches. Accordingly the thickness of the relatively expensive insulating material in the layer 3 will vary from approximately 5½ inches at the top of the stove wall adjacent to the combustion chamber 6 down to about 4 inches at the bottom of the stove wall. Circumferentially the layer 9 may extend through about 60 degrees of the

circumference of the stove wall 1, said layer 2 being symmetrically disposed with respect to the combustion chamber 6. The decrease in diameter from top to bottom of the stove, considering a steel wall of usual thickness, is approximately 12 inches, which produces a saving of about four per cent in the weight of the steel side wall.

A stove having approximately the dimensions hereinabove recited will have a uniformly low heat loss per unit of area throughout the height of the stove.

Owing to the fact that an increased thickness of high-priced insulating material 3 is provided adjacent to the lower portion of the stove wall 1 at the region adjacent to the combustion chamber 6, there would be excessive thickness of said high-priced insulating material toward the top of the stove at said region unless part of the annular space between the ring wall 2 and the shell 4 were taken up with lower-priced materials. This can be accomplished by stepping out the ring wall 2 where required, or by inserting the relatively low-priced insulating material 3. Many of those skilled in the art, in constructing a stove according to the present invention, will therefore digress from the tapering thickness of the high-grade, high-priced insulating material 3 in that segment of the circumference of the stove adjacent to the combustion chamber 6.

Though certain preferred embodiments of the present invention have been described in detail, many modifications will occur to those skilled in the art. It is intended to cover all such modifications that fall within the scope of the appended claims.

What is claimed is:—

1. In a hot blast stove, in combination, a ring wall, said ring wall being formed to provide a combustion chamber disposed adjacent to the side of said stove, an outer steel shell tapering in diameter from top to bottom, the outer surface of said ring wall and the inner surface of

said outer shell cooperating to provide an annular space therebetween tapering in thickness from top to bottom of said stove, the thickness of said annular space being greater adjacent to the lower portion of said combustion chamber than throughout the remainder of the circumference of the lower portion of said stove, and insulating material filling said space.

2. In a hot blast stove, in combination, a ring wall, said ring wall being formed to provide a combustion chamber disposed adjacent to the side of said stove, an outer steel shell tapering in diameter from top to bottom, the outer surface of said ring wall and the inner surface of said outer shell cooperating to provide an annular space therebetween tapering in thickness from top to bottom of said stove, the thickness of said annular space being greater adjacent to said combustion chamber than throughout the remainder of the circumference of said stove, and insulating material in said annular space, the character and proportions of said insulating material being varied to cause a substantially uniform insulating effect in the wall of said stove adjacent to said combustion chamber.

3. In a hot blast stove, in combination, a ring wall, said ring wall being formed to provide a combustion chamber disposed adjacent to the side of said stove, an outer steel shell tapering in diameter from top to bottom, the outer surface of said ring wall and the inner surface of said outer shell cooperating to provide an annular space therebetween tapering in thickness from top to bottom of said stove, the thickness of said annular space being greater adjacent to said combustion chamber than throughout the remainder of the circumference of said stove, and insulating material filling said annular space whereby substantial uniformity of radiation loss is maintained throughout the height and circumference of said stove.

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