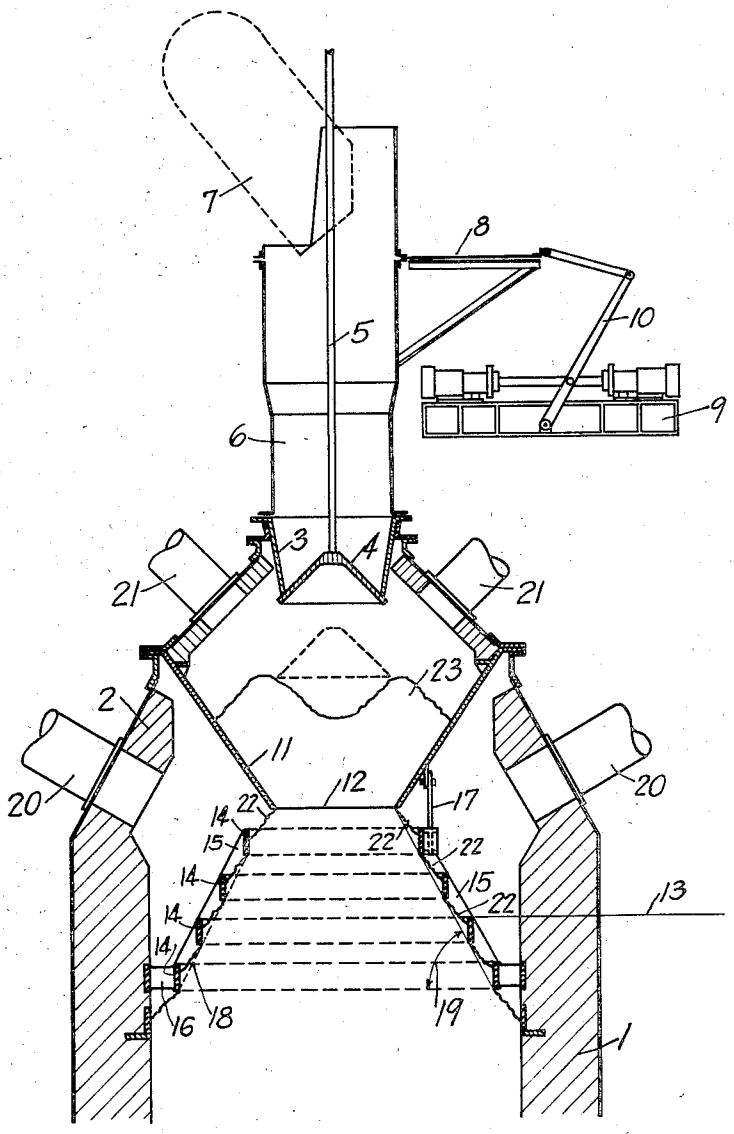
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BLAST FURNACE FILLING DEVICE

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BLAST FURNACE FILLING DEVICE

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The present invention relates to improvements in blast furnace filling devices.

In charging material into blast furnaces it has been customary to provide a pair of bells at the top of the furnace, which bells are arranged in series, one being open while the other is closed, whereby the material may be charged into the furnace without a material escape of gas through the filling means. Furthermore, according to prior practice it has been necessary to provide distributing means to distribute as well as possible the material charged into the furnace. According to prior practice, difficulty has been encountered by reason of the fact that the coarse pieces of material will segregate from the fine pieces, resulting in lack of uniformity of gas flow upward through the furnace charge.

An object of the present invention is to provide an improved structure for charging material to a furnace which is simple both in its parts and in its operation.

A further object is to provide an improved structure for charging material into a blast furnace which will have the result that the breakage of the material into fine pieces is minimized.

A further object is to provide a construction which minimizes undesirable segregation of the material into sizes.

A further object is to provide a construction which so distributes the charge that the amount of dust carried off with the blast furnace gas is minimized.

A further object is to provide blast furnace charging means in which the conventional large bell with its operating mechanism and the conventional distributor with its operating mechanism will be rendered unnecessary.

A further object is to provide a construction which will result in an increase over prior practice in the exposed area at the top of the furnace charge, resulting in lower velocity of the gases issuing from the charge.

A further object is to provide a construction which will produce improved uniformity of gas flow upward through the furnace charge.

Further objects will appear as the description proceeds.

The one figure of the drawing illustrates a preferred embodiment of the present invention.

The numeral 1 indicates a blast furnace, which blast furnace has the usual conical top portion 2. Disposed symmetrically with the top portion 2 is the cone 3, which provides a seat for the bell 4, which bell 4 may be operated through the rod 5 by any preferred means. Disposed above the furnace top 2 is the cylindrical hopper 6, through which material may be conducted to the bell 4, said material being dumped into said cylindrical hopper 6 by means of the skip 7. The cylindrical hopper 6 may be controlled by the gate 8, which will be closed when the bell 4 is in lowered, that is—open, position. The gate 8 may be controlled by means of operating mechanism, indicated by the numeral 9, which operates through linkage or other power transmitting means, indicated by the numeral 10. Supported within the top portion 2 of the furnace is the main hopper 11 disposed coaxially with respect to the furnace and to the bell 4. Said main hopper 11 is frustoconical in contour, the smaller portion being lowermost, and provides the throat 12 disposed substantially coaxially with the furnace 1. The numeral 13 indicates the normal stock line of the furnace, and the throat 12 of the main hopper 11 will be disposed above said normal stock line 13.

Disposed below the throat 12 of the main hopper 11 are a plurality of coaxially disposed louvre rings 14—14 arranged in circumferential echelon. In the illustrated embodiment, four of said rings 14 are provided. Said rings vary progressively in diameter, the ring of smallest diameter being closest to the throat 12. Said rings 14—14 are held in fixed relationship with each other by means of the supporting angles 15—15. The assembly of rings 14—14 is held in fixed relationship with respect to the furnace 1 by means of the struts 16—16 and is suspended from the main hopper 11 by means of a plurality of suspension rods 17—17, of which only one is illustrated in the drawing. Said rings 14—14 are spaced downwardly from the lower extremity of the main hopper 11 and from each other in such a manner that their lower inner extremities are disposed approximately in the surface of a cone, which surface is indicated by the numeral 18. The angle 19 between the surface 18 and a horizontal plane is chosen of a magnitude greater than the angle of repose of the material of the charge within the blast furnace, for a purpose which will be discussed presently. The rings 14—14 should be so disposed that the frustoconical surface 18 defined thereby will be intersected by the normal stock line 13 intermediate of the height of said surface between the throat 12 and the region of intersection of said cone with the furnace wall 1. The numerals 20—20 indicate the conventional gas offtakes, which gas offtakes communicate with the inside of the furnace at a region adjacent to the plane marking

the location of the throat 12 of the main hopper 11. These conventional offtakes 20—20 receive the gas from the surface of the charge bounded by the louvre rings 14—14. The present invention contemplates auxiliary gas offtakes 21—21 communicating with the region above the main hopper 11. These auxiliary gas offtakes 21—21 accommodate and induce gas flow through the part of the charge disposed within said main hopper 11. Said auxiliary gas offtakes 21—21 also induce gas flow through the central portion of the stock column, a function sought for but not attained in blast furnaces as now commonly used.

In operation, material will be fed into the cylindrical hopper 6, the gate 8 being open at this time and the bell 4 being closed. The gate 8 will then be closed and the bell 4 will be opened a sufficient distance to allow the material thereon to be dumped into the furnace 1. As the furnace charge moves downward due to the smelting operation in the lower part of the furnace, the more recently charged material in the main hopper 11 moves downward through the throat 12 into the region bounded by the louvre rings 14—14. This manner of movement entirely avoids the formations of hills and valleys, which characteristically accompany the use of a large bell such as has been customary heretofore in filling a blast furnace. Said hills and valleys permit the heavier material to segregate by rolling down said hills into said valleys, thus forming zones of open texture material and zones of closer texture material, permitting marked segregation of gas flow upward through the charge of the blast furnace. By means of the louvre ring system above referred to, this segregation of coarse and fine material does not occur, and the gas within the furnace is provided with no preferential path by virtue of any difference in openings or texture of the charge.

By reason of the fact that the angle 19 between a horizontal plane and the conical surface constituting the locus of the inner lower edges of the rings 14—14 is greater than the angle of repose of the charge within the furnace, said charge will assume a predetermined outline. The material below the throat 12 will assume an outline defined by a plurality of frusto-conical surfaces, indicated by the numerals 22—22, which plurality of frusto-conical surfaces approximate a single cone of material, bounded at the top by the throat 12 and at the bottom by the diameter of the inner cylindrical surface of the furnace wall. Above the throat 12 will be a pile of material, indicated by the numeral 23. The present invention provides a gas emitting surface of considerably greater area than is provided by the usual type of blast furnace filling means. The same volume of gas will be generated in the smelting operation in the furnace according to the conventional distribution of the charge and according to the distribution hereinabove described. However, inasmuch as the area of the gas emitting surface according to the present invention is greater, the velocity of the gas will be correspondingly less. Consequently less dust will be carried off through the gas outlets.

The provision of the auxiliary gas outlets 21—21 is accompanied by the advantage that the gas distribution throughout the column of the charge in the furnace may be predetermined. For this purpose the size relation between the offtakes 20—20 and 21—21 may be chosen to produce the evenness of distribution desired.

Though a preferred embodiment of the present invention has 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 blast furnace, in combination, a furnace wall, said furnace wall being provided with a top portion, means disposed in said top portion for admitting charge to said furnace, a conical main hopper disposed beneath said admitting means, said main hopper having a throat disposed substantially symmetrically with respect to said furnace wall, and louvre rings within said furnace disposed below said throat, said louvre rings being arranged in circumferential echelon and varying increasingly in diameter from said throat downwardly of said furnace, gas offtakes communicating with the space bounded by said hopper, said rings and said furnace wall, and auxiliary offtakes communicating with the space above said hopper and below said charge admitting means.

2. In a blast furnace, in combination, a furnace wall, said furnace wall being provided with a top portion, means disposed in said top portion for admitting charge to said furnace, a conical main hopper disposed beneath said admitting means, said main hopper having a throat disposed substantially symmetrically with respect to said furnace wall, and louvre rings within said furnace disposed below said throat, said louvre rings being arranged in circumferential echelon and varying increasingly in diameter from said throat downwardly of said furnace, the lower inner extremities of said louvre rings having their loci within a conical surface having an angularity with a horizontal plane greater than the angle of repose of the charge within said furnace, gas offtakes communicating with the space bounded by said hopper, said rings and said furnace wall, and auxiliary offtakes communicating with the space above said hopper and below said charge admitting means.

3. In a blast furnace, in combination, a furnace wall having a top portion, means for admitting charge located in said top portion, a conical hopper below said admitting means, said conical hopper having a throat disposed substantially symmetrically with respect to said furnace wall, and a plurality of rings disposed coaxially with said throat, said rings being disposed in circumferential echelon and increasing progressively in diameter from a region immediately below said throat to a region adjacent to said furnace wall, gas offtakes communicating with the space bounded by said hopper, said rings and said furnace wall, and auxiliary offtakes communicating with the space above said hopper and below said charge admitting means.

4. In a blast furnace, in combination, a furnace wall having a top portion, means for admitting charge located in said top portion, a conical hopper below said admitting means, said conical hopper having a throat disposed substantially symmetrically with respect to said furnace wall, a plurality of rings disposed coaxially with said throat, said rings being disposed in circumferential echelon and increasing progressively in diameter from a region immediately below said throat to a region adjacent to said furnace wall, and gas offtakes in said furnace wall communi-

cating with the space bounded by said hopper, said louvre rings and said furnace wall, and auxiliary gas offtakes communicating with the space above said hopper and below said charge admitting means.

5. In a blast furnace, in combination, a furnace wall having a top portion, means for admitting charge located in said top portion, a conical hopper below said admitting means, said conical hopper having a throat disposed substantially symmetrically with respect to said furnace wall, a plurality of rings disposed coaxially with said throat, said rings being disposed in circumferential echelon and increasing progressively in diameter from a region immediately below said throat to a region adjacent to said furnace wall, gas offtakes in said furnace wall communicating with the space bounded by said hopper, said louvre rings and said furnace wall, and auxiliary gas offtakes for discharging gas from the space within said furnace above said conical hopper and below said charge admitting means.

6. In a blast furnace, in combination, a furnace wall having a top portion, means for admitting charge located in said top portion, a conical hopper below said admitting means, said conical hopper having a throat disposed substantially symmetrically with respect to said furnace wall, and a plurality of rings disposed coaxially with said throat, said rings being disposed in circumferential echelon and increasing progressively in diameter from a region immediately below said throat to a region adjacent to said furnace wall, the lower inner extremities of said louvre rings having their loci within a conical surface having an angularity with a horizontal plane greater than the angle of repose of the charge within said furnace, gas offtakes communicating with the space bounded by said hopper, said rings and said furnace wall, and auxiliary offtakes communicating with the space above said hopper and below said charge admitting means.

7. In a blast furnace, in combination, a furnace wall having a top portion, means for admitting charge located in said top portion, a conical hopper below said admitting means, said conical hopper having a throat disposed substantially symmetrically with respect to said furnace wall, a plurality of rings disposed coaxially with said throat, said rings being disposed in circumferential echelon and increasing progressively in diameter from a region immediately below said throat to a region adjacent to said furnace wall, and gas offtakes in said furnace wall communicating with the space bounded by said hopper, said louvre rings and said furnace wall, the lower inner extremities of said louvre rings having their loci within a conical surface having an angularity with a horizontal plane greater than the angle of repose of the charge within said furnace, and auxiliary gas offtakes communicating with the space above said hopper and below said charge admitting means.

8. In a blast furnace, in combination, a furnace wall having a top portion, means for admitting charge located in said top portion, a conical hopper below said admitting means, said conical hopper having a throat disposed substantially symmetrically with respect to said furnace wall, a plurality of rings disposed coaxially with said throat, said rings being disposed in circumferential echelon and increasing progressively in diameter from a region immediately below said throat to a region adjacent to said furnace wall, gas offtakes in said furnace wall communicating with the space bounded by said hopper, said louvre rings and said furnace wall, and auxiliary gas offtakes communicating with the upper portion of the space within said conical hopper and below said charge admitting means, the lower inner extremities of said louvre rings having their loci within a conical surface having an angularity with a horizontal plane greater than the angle of repose of the charge within said furnace.

9. In a blast furnace, in combination, a furnace wall, said furnace wall being provided with a top portion, means disposed in said top portion for admitting charge to said furnace, a conical main hopper disposed beneath said admitting means, said main hopper having a throat disposed substantially symmetrically with respect to said furnace wall, and louvre rings within said furnace disposed below said throat, said louvre rings being arranged in circumferential echelon and varying increasingly in diameter from said throat downwardly of said furnace, the lower inner extremities of said louvre rings having their loci within a conical surface having an angularity with a horizontal plane greater than the angle of repose of the charge within said furnace, each of said rings being of sufficient height with respect to the vertical distance between it and the ring next above, such that the charge within said rings lying at its angle of repose will not overflow the tops of said rings, gas offtakes communicating with the space bounded by said hopper, said rings and said furnace wall, and auxiliary offtakes communicating with the space above said hopper and below said charge admitting means.

10. In a blast furnace, in combination, a furnace wall, said furnace wall being provided with a top portion, means disposed in said top portion for admitting charge to said furnace, a conical main hopper disposed beneath said admitting means, said main hopper having a throat disposed substantially symmetrically with respect to said furnace wall, means within said furnace wall for defining a substantially conical surface of the charge within said furnace below said main hopper, gas offtakes for taking off gas from said conical surface of said charge, and auxiliary gas offtakes communicating with the space above said hopper and below said charge admitting means for inducing gas flow through the central portion of the stock column within said wall.

11. In a blast furnace, in combination, a furnace wall, said furnace wall being provided with a top portion, means disposed in said top portion for admitting charge to said furnace, a conical main hopper disposed beneath said admitting means, said main hopper having a throat disposed substantially symmetrically with respect to said furnace wall, louvre rings within said furnace disposed below said throat, said louvre rings being arranged in circumferential echelon and varying increasingly in diameter from said throat downwardly of said furnace, rigid supporting members for holding said rings in fixed position relative to one another, and supporting means for holding said rings in fixed relationship with said hopper and with said furnace wall.

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