METHOD OF CHARGING BLAST FURNACES.

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To all whom it may concern:

Be it known that Arthur G. McKee, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Methods of Charging Blast-Furnaces, of which the following is a specification.

This invention relates to a novel method of charging blast furnaces whereby to effect a desirable distribution of the stock therein.

The invention is more particularly applicable to that class of centrally filled furnaces served by skips, wherein a seed is effected by means of double bells, and wherein such successive skip-load of furnace stock as is 15 delivered is distributed around the vertical axis of the upper bell, as in most mechanically filled furnaces in use at the present time. It has been found that the procedure in furnaces thus filled results in the separation or classification of the material delivered thereto.

That is, the relatively moist and fine particles are constantly delivered in one neighborhood, while the coarse, drier and more lively moving lumps are delivered to another neighborhood. The effect of this is that one zone or portion of the column of stock contained in the furnace is more easily penetrated by the ascending gases, which causes caprices in the descent of the stock and in the reduction of the ore, and many attendant 25ills well known to those acquainted with the practical side of blast furnace operations. It is also found that in this class of furnaces irregularities of quantity as well as quality sometimes arise on opposite sides of the center.

The object of my invention is to provide a method of delivering seed to the furnace by means of which this 30irregularity or error itself in the delivery of an increment of the stock whether of quality or quantity may be distributed with uniformity around the vertical axis of the furnace; and the described portion which is more open or free to the passage of the gas may be disposed so as to avoid the creation of a column of stock on one side of the furnace more susceptible to the penetration of the gases and more quickly reducible than the other portions of the stock.

In other words, the object of the invention is to supply the stock to the furnace in an improved manner which shall prevent the localization of the heating and reducing effect and cause the latter to act with uniformity throughout the entire cross-section of the stock at all points in the height of the column.

50 In order to render the disclosure of my novel method entirely clear and to illustrate a practical application thereof, I have shown in the accompanying drawing a simple form of apparatus wherein the invention may be carried out, in which the figure shows a vertical axial section of a blast furnace top, with the feeding skips and other supporting devices appearing in side elevation.

Referring to the drawing, 5 may designate the top portion of the furnace, in the upper end of which is secured a fixed hopper 6 having its lower or bottom opening controlled and normally closed by a bell 7, while its top opening is covered by a frusto-conical cap 8, upon which is secured the receptacle 9, the lower opening of which is controlled and normally closed by a bell or other suitable closure 10. As herein shown, the receptacle 9 is of cylindrical form for some distance above the closing bell 10, and has a flaring or hoppered shaped upper end that is served by the usual skips 11. The receptacle 9 is mounted so as to be rotateable on its vertical axis, and such rotary movement may be imparted by any suitable or convenient driving gear such as the belt 12 passing around the fixed pulley 13 on the receptacle and guided over one or more sheaves 14.

Means are provided for raising and lowering the bells 7 and 10, the means herein shown for controlling the bell 7 consisting of a rod 15 connected to the latter and at its upper end suspended from one arm of a lever 16 pivoted on a suitable support 17. Said lever 16 has a counterweight 18 normally tending to raise the bell and maintain it in closing position, while a cylinder 19 having its piston rod 20 pivoted to the lever 16, operates to effect the lowering of the bell at the desired intervals. A similar mechanism may serve to control the rising and falling movements of the bell 10, the latter being shown as provided with a tubular connection 21 through which the rod 15 may pass, said connection having secured to its upper end a bearing disk 22 preferably resting upon balls 23 which travel in an annular race-way 24 formed in a yoke 25. This yoke is suspended as by means of a flexible cable or chain 26 from a segment 27 on the end of a lever 28 pivoted on a support 29 having a counterweight 30 and an operating cylinder and piston-rod 31 and 32, respectively.

In the said construction as heretofore used, where the receptacle 9 has been of stationary form it has been found that the greater portion of the larger and coarser lumps of stock was always deposited on the side of the receptacle opposite or nearly so to the point of dumping (dependent upon the particular form of the receptacle 9 used in each case), and the greater portion of the fine particles and dust was always deposited at a point near or immediately below the dumping point. This segregation of the coarse and fine material has been continued in much the same proportion during its passage through the lower hopper and furnace, with the result that the gases have found easier passageway up the side of the furnace containing the preponderance of lumps and coarser particles, with a resulting bad working of the furnace and early destruction of its lining. This is
entirely prevented by my new and improved method of feeding the stock, which will be readily apparent from the following description of the operation of the
5 typical apparatus described for carrying out the same. Assuming that the receptacles 6 and 9 are closed by their respective bells, the skip-loads of material are dumped into the receptacle 9 from the skips 11 at any desired intervals. After each skip-dumping operation, said receptacle is rotated partially, and the lever 28 is
10 then actuated to lower the bell 19 and deposit the load in the hopper 6. These successive partial rotations or angular movements of said receptacle 9 are made of a length increasing successively by equal increments, so that the lumpy portion of each skip-load, after the latter
15 has been deposited in the receptacle 9, is deposited in the underlying hopper 6 at a point differing from that at which such lump of the immediately preceding load were deposited. It will therefore be seen that the large lumps and the finer material are successively delivered at different points. Any irregularities in the relative quantities of stock delivered to opposite sides of the center are likewise distributed. When the hopper 6 has been filled to the desired extent, the lever 16 is actuated by its cylinder 19 to lower the bell 7, and the contents of the hopper are deposited in the furnace. By virtue of the fact that each skip-load as it is delivered to the receptacle 9 is automatically distributed entirely around the vertical axis of the latter, the successive skip-loads are deposited in the same relation to the axis and in the form of comparatively thin layers of stock spread over the center of the furnace, with the coarse and fine particles of successive layers distributed around the axis as described, which arrangement and
35 distribution of the stock affords almost ideal conditions for intimate contact and easy chemical reaction between adjacent layers. The distribution of the lime-
40 stone or flux in this manner is required in order that a uniform slag may result; but if the operator for any reason desires to make the layers of other materials thicker,
45 this can readily be accomplished by charging two or more skip-loads of the one material in succession.

From the foregoing it will be seen that the central and essential feature of my invention resides in such arrange-
50 ding of the stock as it is fed into the furnace as affects a distribution of the irregularity or error of each successive charge of stock around the vertical axis to the furnace, this causing the body of stock contained in the furnace to present substantially equal and uniform resistance to the passage of the ascending currents at all points in its cross-section. This is indicated in an exaggerated form in the drawings, wherein the natural tendency of relative distribution of the particles of each skip-load in the upper rotary receptacle, and the distribution of the irregularity or error in the lower receptacle
55 or hopper is roughly shown.

I claim:

1. A method of charging blast furnaces which consists in delivering the charges into a chamber in such a manner as to cause the material of each charge to roughly separate into two portions one of which is coarse and the other fine, and subsequently depositing such charges from the chamber into the furnace in such a manner that the coarser particles are delivered onto the finer particles of a previously deposited charge and vice versa, substantially as described.

2. A method of charging blast furnaces which consists in delivering the charges into a chamber in the form of annular layers or rings around the vertical axis of the furnace with the coarser particles lying on one side of said axis and the finer particles on the opposite side, partially rotating successive charges in said chamber through different angles, and finally depositing such charges one on top of another in the furnace, whereby the irregularities of successive charges of stock are distributed throughout the entire cross-section of the furnace, substantially as described.

3. A method of charging blast furnaces which consists in delivering the successive portions of material into a hopper or other receptacle in a manner approximating uniform distribution of each portion about the center of said hopper, and rotating said portions through different angles before placing them in the furnace, whereby to equalize any irregularities of quantity or quality, substantially as described.

ARTHUR G. MCKEE.

WITNESSES:
L. QUINBY,
L. ROSE ELLETT.