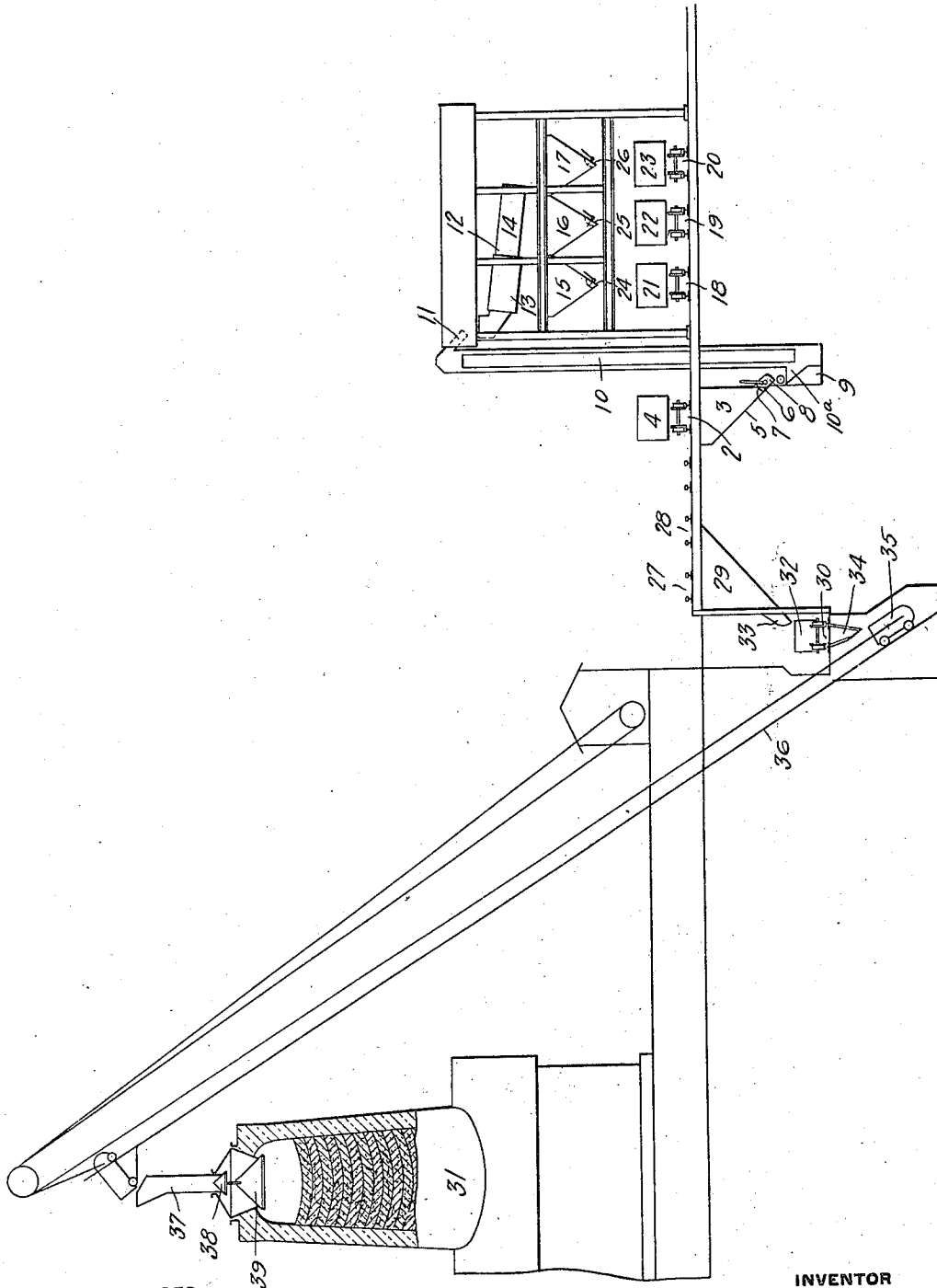


A. J. BOYNTON.
METHOD OF CHARGING BLAST FURNACES.
APPLICATION FILED AUG. 21, 1915.

1,167,883.

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WITNESSES

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METHOD OF CHARGING BLAST-FURNACES.

1,167,883.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ARTHUR J. BOYNTON, a citizen of the United States, residing at Lorain, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Methods of Charging Blast-Furnaces, of which the following is a specification.

My invention relates to the charging of blast furnaces, and the distribution within the top of the furnace shaft of the coke, limestone, ore and other raw materials used in forming the furnace burden.

Heretofore the charges of raw materials used in forming the furnace burden have been carried to the top of the furnace and delivered into the main charging hopper without regard to the size of the material or mixture of materials forming the successive charges put into the main hopper. As a result such charges are made up of various sizes of material ranging from finely divided portions to large lumps. When such conglomerate charges are delivered into the main charging hopper the coarse and fine materials separate and become segregated, the fine portion of the charge being deposited on one side and the larger or coarse portions on the opposite side of the charging hopper, and when the lower charging bell used to close the main charging hopper is lowered the segregated materials are discharged into the top of the blast furnace in their segregated condition so that the desired uniform distribution of coarse and fine materials within the furnace is not obtained.

The primary object of my invention is to provide a novel method of charging blast furnaces wherein the raw materials forming the furnace burden are classified according to size, and charges formed of the classified or sized materials are delivered to and distributed within the main charging hopper of the furnace and whereby segregation of coarse and fine portions of the charges is avoided and prevented and the desired uniform distribution of coarse and fine portions of the charge within the charging hopper is obtained.

The invention consists in a method of charging blast furnaces wherein the coke, the limestone, dolomite, or other fluxing material, and the iron, manganese or other metal bearing ore used in forming the furnace burden, are separated into a plurality of classes of definite size or between certain

predetermined maximum and minimum sizes preparatory to making up the charges put into the main charging hopper of the furnace, and wherein the successive charges of raw materials put into the main charging hopper of the furnace are made up of a material (or mixture of materials) of a certain class or range in size.

The invention further consists in the improved method of handling the raw materials in classifying or separating the materials according to size, as will be more fully described hereinafter and specifically pointed out in the appended claims.

The drawing forming part of this specification is an elevation showing diagrammatically one arrangement of apparatus adapted for use in charging blast furnaces in accordance with my improved method.

In the accompanying drawing, the numeral 2 designates a railway track which extends above a bin 3 (or series of such bins) and which forms part of the track system of a blast furnace plant. Cars 4 loaded with raw materials are positioned above the bin 3 on the track 2 in discharging their contents into the bin 3. The bin 3 is provided with a sloping bottom 5, and gravity discharge opening 6, a gate or door 7 having a suitable operating mechanism being employed to normally close the discharge opening or outlet 6, and a chute 8 to receive the materials as discharged from the bin.

In front of the bin 3 is a pit 9 having the boot 10 of a hoist or elevator 10 therein arranged to receive the materials from the bin 3 as discharged through the bin outlet 6 and chute 8. The elevator 10 lifts and discharges the materials into the inclined chute 11 at the top of the elevator and the materials flow by gravity through the chute 11 into the receiving end of the cylindrical, axially inclined rotary barrel 12.

The periphery of the barrel 12 is perforated, or covered with screening, the portion 13 of the periphery of the barrel adjoining the receiving end and covering approximately one-half the length of the barrel having small holes or fine screening, and the other portion 14 adjoining the discharge end having larger holes or coarse screening, so that the smaller sizes of materials discharged into the rotating barrel 12 are caused to pass through the smaller of the perforations or holes in the barrel into the first of the three bins 15, 16, and 17 located

beneath the barrel, and other portions of the materials somewhat larger in size pass through the openings in the other portion of the barrel into the bin 16, while portions of still larger size are caused to travel through the inclined barrel 12 and pass from the open lowermost end thereof into the last bin 17, and in this way the coke, limestone, ore, or other material being classified is separated into different sizes and the separated sizes are deposited according to size into one or another of the bins 15, 16 and 17. The barrel 12 being inclined axially and being rotated will cause materials to travel lengthwise within the barrel from the receiving end toward the discharge end thereof.

While three bins 15, 16 and 17, are shown arranged to receive three different sizes of classified materials from the screening barrel 12, the number of these bins and the number of sizes or classes into which the materials are separated or classified may be increased (or lessened), as is found necessary or desirable. Beneath the bins 15, 16 and 17, which are shown elevated above the ground level, are tracks 18, 19 and 20 which are connected to the track system of which the track 2 is part, and on the tracks, below the bins, are transfer cars 21, 22 and 23, arranged to receive the classified materials as discharged from the outlets 24, 25 and 26 on the bottom of the respective bins 15, 16 and 17.

The sized or classified materials are loaded into the cars 21, 22 and 23 from the bins 15, 16 and 17, one size or class of material being put into each car. The loaded cars 21, 22 and 23 are then transferred on the tracks of the yard system to one or the other of the tracks 27, 28, above the series of bins 29 which are located in front of the depressed lorry track 30 extending lengthwise in front of the blast furnace or a group of blast furnaces 31. The contents of the cars are unloaded into the bins 29, each bin receiving one kind and size of material. The lorry car 32 on the depressed track 30 is designed to hold a charge (the quantity hoisted to the top of the furnace at one time in the furnace skip cars). When forming a furnace charge the lorry car 32 is moved on the track 30 until in front of the discharge spout or chute 33 on the bin 29 which contains the desired material of the desired class or size. The gate or shutter controlling the outlet of this bin is then opened and the required amount of material flows from the bin into the lorry car by gravity. The lorry car 32 then transfers and discharges the charge of material into the chute 34 by which the materials are delivered into the skip cars 35 on the skip car track 36 leading from the base of the blast furnace 31. The skip car 35 is then hoisted on the skip track 36 to the top of the furnace 31

and the materials therein are discharged into the throat 37 on the top of the furnace, and are thereby deposited on the upper bell 38 of the furnace charging apparatus. The upper bell 38 is then lowered to discharge the materials supported thereon into the main charging hopper which is closed by the main bell 39. The bell 39 is then lowered and the materials within the main charging hopper are caused to descend into the top of the furnace shaft.

In the operation of charging blast furnaces by my improved method, the raw materials are delivered by railway cars 4 on the track 2 into the bin or series of bins 3. The different kinds of materials are placed in separate bins or at different times into one bin 3 without reference to the size of the materials. The material in the bin 3 is then discharged into the boot 10^a of the elevator 10 and is hoisted to the top of the elevator and discharged through the chute 11 into the receiving end of the rotating cylindrical barrel or drum 12. In passing through the barrel 12 the smaller sizes of the material fall through the smaller perforations or interstices in the periphery of the barrel, into the overhead bin 15. Coarser portions of the materials travel lengthwise within the barrel and the next larger size of the material falls through the larger perforations in the lower half of the barrel 12 into the second bin 16. Portions of the material of larger size pass through the barrel 12 and are discharged from the lower end thereof into the bin 17, so that the material in being classified is separated roughly by size into three classes with the apparatus shown.

The above described operation is performed separately with the coke, limestone, ore, and each of any other materials used in forming the furnace burden, so that each particular material is separated by size into classes. The classified materials are then withdrawn from the overhead bins as the bins become filled with any one size, into one or another of the transfer cars 21, 22, 23, positioned on the tracks 18, 19, 20, beneath the overhead bins. The material from any one bin is then transferred in the cars on the tracks of the yard system and are discharged into one of the group of bins 29. In making up a charge for the furnace, materials of a given size are withdrawn from the bins 29 and are deposited within the lorry car 32 on the depressed track 30 at one side of the row of bins, and the successive charges withdrawn from the bins are discharged from the lorry car 32 into the skip car 35 which is positioned on the skip track 36 at the base of the furnace. Such charges usually are formed of one kind of material but may be formed of two or more of the same class as to size, when found necessary

or desirable. The skip car 35 is then hoisted to the top of the furnace and dumped, so as to deliver the charge of materials therein into the throat 37 of the furnace charging apparatus. The upper bell 38 is then lowered to deliver the charge of materials into the lower or main charging hopper. In depositing the successive charges of classified material within the main charging hopper the charge of material, being of the same size or within the desired range in sizes, is uniformly distributed within the hopper. The size of the material forming one charge may differ from that of the preceding or succeeding one, but each charge being formed of portions of substantially equal size is uniformly distributed within the main charging hopper, and this substantially uniform distribution of the materials will be maintained within the furnace when the materials are discharged from the main charging hopper into the top of the furnace. The lower bell 39 is then lowered and the materials within the charging hopper are delivered into the top of the blast furnace shaft. The above described operations are then repeated with each of the various materials used in forming the furnace burden and the sized materials are put into the furnace by classes, instead of being indiscriminately mixed as to size when put into the furnace, as has been the practice heretofore.

The advantages of my invention will be apparent to those skilled in the art. By classifying the raw materials preparatory to forming charges to be put into the blast furnace, and by making up the charges of materials of a definite size or between predetermined limits as to size, more uniform distribution of the materials forming the furnace burden is obtained within the furnace.

Obviously the apparatus used in classifying and handling the raw materials in carrying out my improved method may be varied without departing from the invention as defined in the appended claim

I claim:—

1. The method of charging blast furnaces which consists in separating the raw material used in forming the furnace burden into classes according to size, and forming the charges put into the furnace from material of a given class preparatory to depositing the charges in the furnace.

2. The method of charging blast furnaces which consists in separating the raw material used in forming the furnace burden into classes according to size and kind, storing the classified material according to class and kind, and forming the charges put into the furnace of a given size and kind preparatory to depositing the charges in the furnace.

3. The method of charging blast furnaces which consists in separating the raw materials used in forming the furnace burden into a series of classes according to size, and forming the charges put into the furnace from material of a given class preparatory to depositing the charges within the furnace.

4. The method of charging blast furnaces which consists in separating the ore used in forming the furnace burden into classes according to size, and forming the charges of ore put into the furnace from ore of a given class preparatory to depositing such charges in the furnace.

In testimony whereof I have hereunto set my hand.

ARTHUR J. BOYNTON.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."