Jan. 26, 1954 E. T. A. TESCH ET AL 2,667,278

APPARATUS FOR CHARGING SHAFT FURNACES

Filed June 20, 1952 4 Sheets-Sheet 1

Fig. 1.

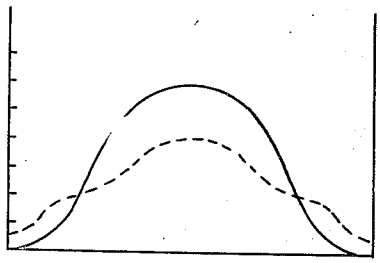


Fig. 2.

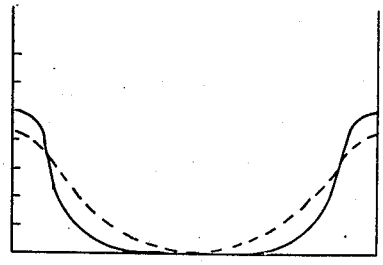


Fig. 3.

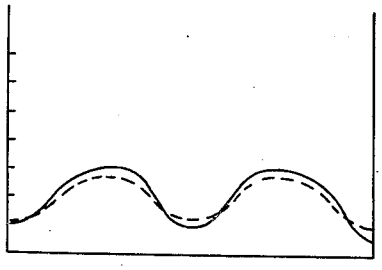
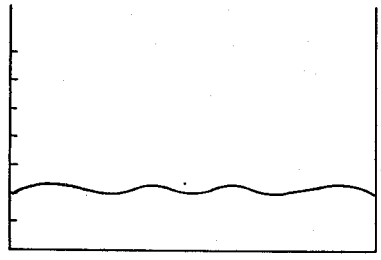


Fig. 4.



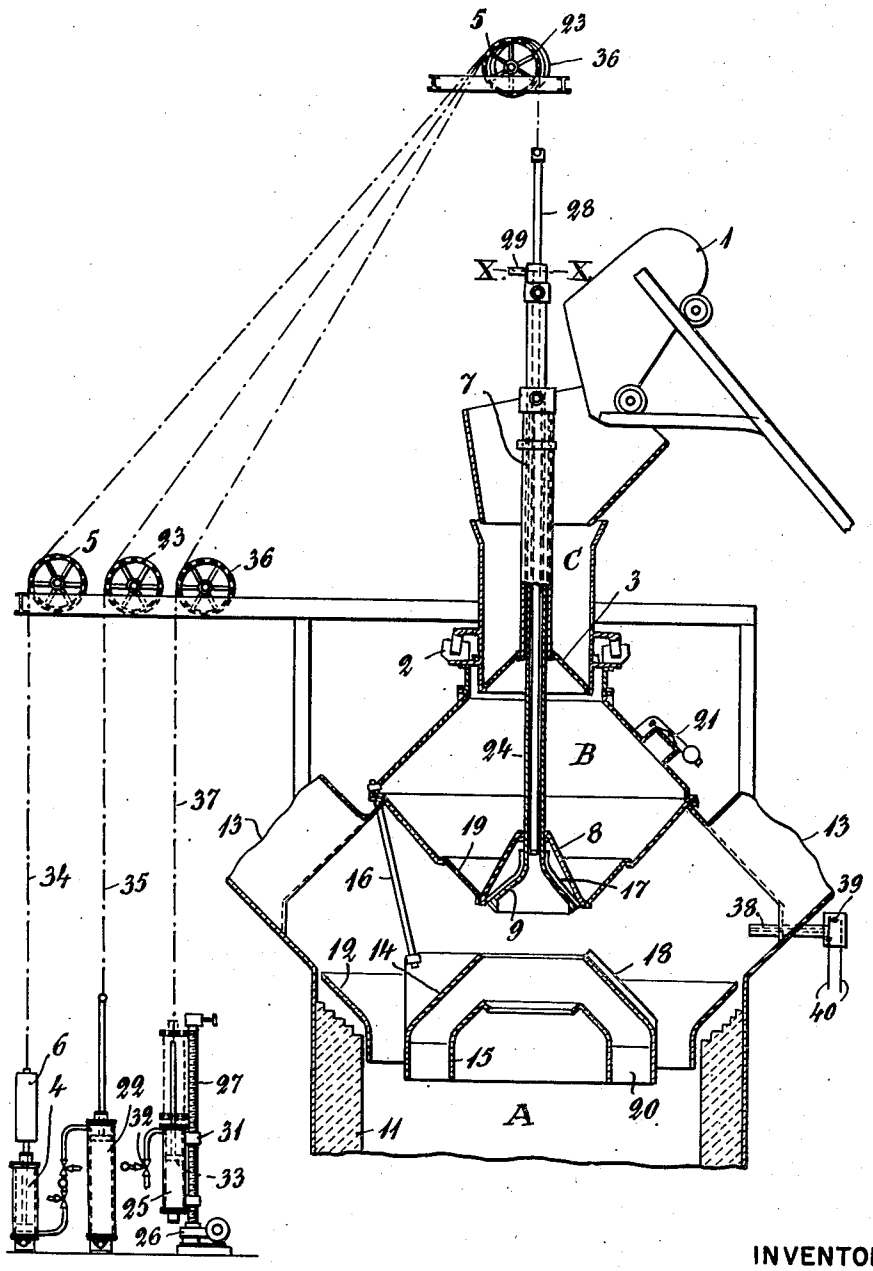
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APPARATUS FOR CHARGING SHAFT FURNACES

Filed June 20, 1952 4 Sheets-Sheet 2

Fig. 5.



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APPARATUS FOR CHARGING SHAFT FURNACES

Filed June 20, 1952 4 Sheets-Sheet 3

Fig. 6.

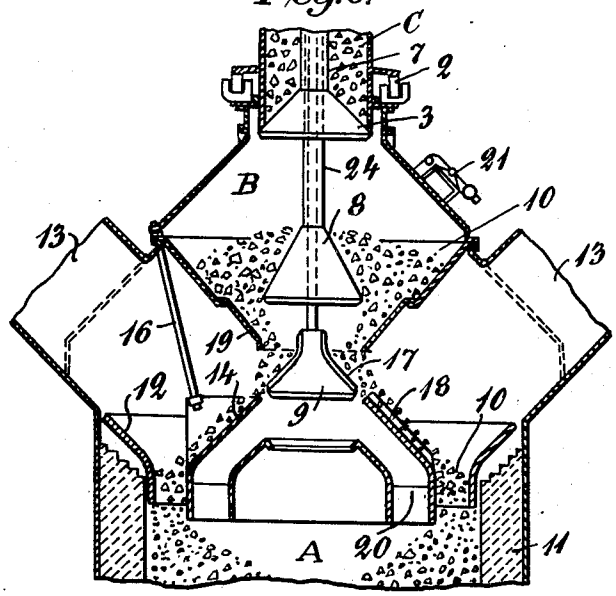
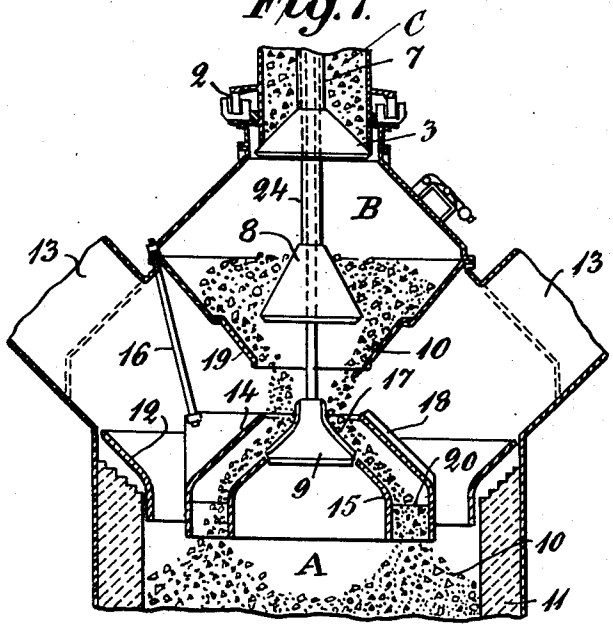


Fig. 7.



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APPARATUS FOR CHARGING SHAFT FURNACES

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4 Sheets-Sheet 4

Fig.8.

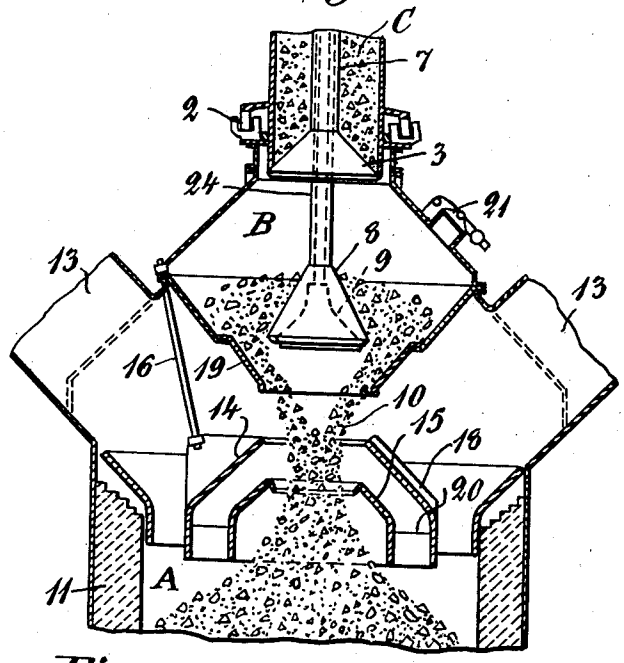


Fig.9.

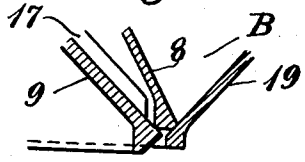


Fig.10.

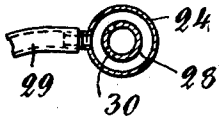


Fig.11.

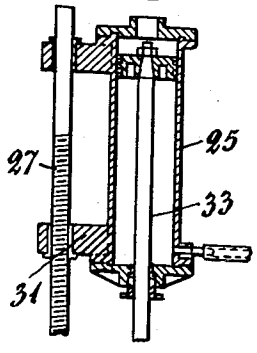
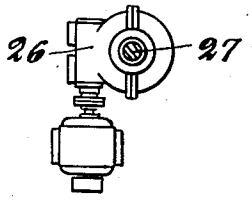


Fig.12.



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APPARATUS FOR CHARGING SHAFT FURNACES

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Application June 20, 1952, Serial No. 294,626

Claims priority, application Sweden January 9, 1952

3 Claims. (Cl. 214—36)

1

When charging shaft furnaces with a stock comprising pieces of varying sizes it is important, in order to ensure that the furnace functions economically and without disturbances, to supply the stock to the furnace in such manner that the least possible irregularity in the density of the furnace charge is obtained. Otherwise the ascending gases in the furnace will pass more rapidly and at a greater rate through some portions of the furnace than through the other portions, which results in a low efficiency.

When charging for instance a blast furnace the stock is generally passed over a cone (bell) which in its raised position forms a gas-tight seal between the furnace and the charging hopper above the furnace. In that case the stock slides concentrically towards the wall of the furnace and forms a slope from the wall down towards the center of the furnace. In order to ensure against the greater gas permeability thereby imparted to the stock in the central part of the furnace as compared to the zone adjacent the wall (circumference) of the furnace, it has been proposed to arrange a double bell below the charging hopper so as to cause the stock to be dumped alternatingly at the circumference and the center of the furnace. In order to make this method of charging the furnace possible the bottom wall of the charging hopper is formed with a funnel shape and the bottom opening is closed by a conical bell below which there is a second conical slightly smaller bell which may be raised into the upper bell. The upper bell is vertically movable within the charging hopper while the lower bell may also be lowered below the charging hopper. When the stock is emptied from the charging hopper into the furnace by simultaneously raising both bells the stock is dumped in the central portion of the furnace forming a slope toward the circumference of the furnace. When on the other hand the lower bell is lowered below the charging hopper and the upper bell is raised within the charging hopper the flow of stock sliding downwardly is distributed by the lower bell towards the circumference of the furnace and the stock forms a slope toward the central portion of the furnace.

In order to facilitate the feeding of the sliding stock towards the circumference of the furnace in cases where the diameter of the lower bell is relatively little as compared to the diameter of the furnace it has also been proposed to arrange within the furnace a fixed stock distributor formed as a frustoconical casing placed so as to serve, when the lower bell is lowered to its lowermost position, as an extension of the lower bell and thus increasing its diameter.

2

It has been established by experiments that for furnaces of large top diameter the distribution obtained by the above described arrangement or by any other known method of charging may be substantially improved. The important feature is namely to obviate the disadvantage of a higher density of the stock at the circumference and in the central portion of the furnace compared with the density in the annular intermediate zone.

This improvement is obtained by the present invention which has for its object an apparatus for charging shaft furnaces comprising a charging hopper with a double bell wherein the lower bell is adapted to be set in two or more fixed positions in its vertical movement below the bottom opening of the charging hopper, and corresponding to each of said fixed positions a fixed stock distributor shaped as a frustoconical casing and adapted to serve, when the bell is set in its corresponding fixed position, as an extension of the bell to the desired diameter, so as to ensure feeding of the charging stock to the desired annular zone intermediate the central portion and the circumferential portion of the furnace. The invention also includes means for moving the lower bell, said means comprising two separate hoisting mechanisms, one of which serves to effect the movement of the lower bell and its setting relatively to the fixed stock distributors, while the other serves to act upon the bell to cause it to accompany the upward movement of the upper bell above the bottom opening of the charging hopper when the stock is fed to the central part of the furnace.

In order to prevent any dust carrying gas from the furnace to enter the space between the lifting rods for the bells which are tubular and concentrically combined, the invention also contemplates means with a tubular connection to the upper portion of the free spaces in and between the lifting rods for blowing a cool purified gas into said spaces, which gas passes downwardly and enters the furnace.

In order to explain how the stock is distributed in the furnace with charging means heretofore employed and the distribution rendered possible by means of the present invention reference will now be had to Figures 1 to 4 on the attached drawings which show graphically the gas permeability of the stock in different zones of the transverse section of the furnace.

The gas permeability is represented by the

vertical axis while the horizontal axis represents the diameter of the furnace.

Figure 1 shows how the gas permeability increases from the walls of the furnace towards the center of the furnace, when the stock is charged along the walls of the furnace. Fig. 2 shows how the gas permeability decreases from the furnace wall towards the center of the furnace when the stock is charged centrally of the furnace. Figure 3 shows the variation of the gas permeability when the charging is made alternatingly centrally and circumferentially of the furnace. In all three cases it will be observed that the gas permeability is far from regular so that the metallurgical processes will be uneconomical and uneven as a result thereof.

In order to obviate these disadvantages the present invention proposes to employ two or more annular stock distributors as explained above so that the introduction of the stock into the furnace may take place not only adjacent the walls and at the center of the furnace but also in a desired number of annular zones intermediate the wall and the center of the furnace. By employing two such stock distributors within the furnace, one concentrically around but spaced apart from the other, a considerably more uniform and thus more satisfactory stock distribution may be obtained than hitherto possible; Fig. 4 serves to illustrate how the gas permeability varies in such a case. As will be seen a practically constant gas permeability is obtained in all parts of the furnace in contrast to Figures 1 to 3.

Figures 5 to 12 illustrate a charging apparatus arranged in accordance with this invention.

Figures 5, 6, 7 and 8 show the charging hoppers, the charging apparatus and the furnace top in longitudinal section with the bells in four different operative positions. Figure 9 illustrates a detail of Figure 5 on a larger scale, Figure 10 is a section along the line X—X in Figure 5. Figures 11 and 12 show also on a larger scale a detail of Figure 5 in vertical section and from above respectively.

The shaft furnace is indicated at A, the lower hopper of the charging device is shown at B and the upper hopper thereof at C. The stock is in the illustrated example shown as supplied to the furnace by means of a skip car 1. After a sufficient amount of stock has been supplied to the hopper C, which is shown rotatably supported by rollers 2 the conical bell 3 is lowered. In the embodiment shown on the drawing this is effected by means of a compressed air cylinder 4, two sheaves 5 with a counterweight 6, one cable 34 and a tubular suspension rod 7. The charging stock is thereby dumped from the hopper C to hopper B, whereupon the hopper C is again closed by raising the bell 3 until it abuts against the lower rim of the hopper C.

Thereupon the stock is emptied from the hopper B down into the shaft furnace A. In the embodiment shown on the drawings this may be achieved in three different ways. The lower bell 9 which is carried by the hollow rod 28 may be lowered as shown in Figure 6 so as to close the central opening in the outer conical stock distributor casing 14, whereupon the bell 8 is raised. The stock 10 will then slide annularly into the furnace through the space between the lower cylindrical portion of the outer stock distributor 14 and an annular lining 12 disposed along the uppermost part of the furnace wall 11 and serving to protect the wall from wear. In this manner circumferential charging is obtained.

If the lower bell 9 is further lowered as shown in Figure 7 so as to close the opening of the inner conical stock distributor casing 15 the stock 10 will slide downwardly through the annular space between the stock distributor 14 and the stock distributor 15 disposed within said first distributor 14. Thereby an annular intermediate charging is obtained. By maintaining the lower bell 9 within the hopper B according to Figure 5 and raising both bells together as shown in Figure 8 a central charging is obtained as the stock 10 will then drop vertically through the central openings in both stock distributor casings 14 and 15 to the central part of the furnace.

The bell 9 is provided with ribs 17 and the stock distributor 14 with ribs 18 which serve to guide the sliding stock readily outwardly into the furnace.

Figure 9 shows in detail how the bell 8 engages the bottom wall 19 of the hopper B so as to form a gas-tight seal and also how the bell 9 fits into the bell 8. It will also be noted from this figure that the bell 9 may pass through the bottom opening of the hopper B.

The stock distributor 14 is fixed and is supported by for instance a number of rods 16. The stock distributor 15 is connected to the stock distributor 14 by means of a number of spokes 20. 13 designates the gas outlet tubes while 21 is a manhole cover and explosion door for the hopper B.

The bell 8 in the shown embodiment is operated by means of the compressed air container 22, four sheaves 23, two cables 35 and the tubular lifting rod 24 which is disposed within the lifting rod 7 of the bell 3.

The bell 9 is operated by means of two hoisting means, one consisting of a compressed air cylinder 25 and the other comprising a power driven worm gear 26 and worm 27. The compressed air cylinder 25 serves to move the bell 9 from the position shown in Figure 5 to the position shown in Figure 6, said cylinder 25 being capable by means of the piston 33 connected to the lifting rod 28 of raising the bell 9 alone but not the bell 8. The adjustment and setting of the bell 9 in the position of Figure 7 is obtained by the worm gear 26 and the worm 27 in that the cylinder 25 engages the worm 27 by means of an arm 31. When setting the bell 9 in the positions corresponding to Figures 6 and 7 the supply of compressed air to the cylinder 25 is discontinued by closing the valve 32.

The manipulation of the device regulating the travel of the bell 9 between its different positions may be regulated by hand or preferably automatically.

The lifting movement of the plunger 33 respectively the worm gear 26 is acting on the lifting rod 28 by means of two cables 37 running over four sheaves 36.

A tube connection 29 serves for blowing cool purified gas into the tubular lifting rods 24 and 28. The passage of gas to the inner rod 28 is through the holes 30 provided in the rod wall.

To attain the movement of the plungers 4, 22 and 25 may, instead of compressed air, a liquid under pressure be used.

On Fig. 5 there has been indicated a thermostat 38 which, when a certain temperature is reached, acts on a contact 39. Electric conductors 40 connected to an electric appliance of known type may be attached to the driving de-

vice of the blowing engines so as to reduce or entirely shut off the air supply, should the temperature at the top of the furnace increase to a degree that will hurt or endanger the charging apparatus of the furnace top.

Having now particularly described the nature of our invention and the manner of its operation what we claim is:

1. Apparatus for charging a shaft furnace, particularly a blast furnace, comprising a charging hopper, an upper conical bell closing the bottom opening of the hopper and adapted to be raised above its closing position, a lower bell having a diameter smaller than the bottom opening of the hopper and adapted to be either raised above or lowered below the bottom opening of the hopper, and a pair of fixed, spaced frustoconical stock distributors arranged one above and around the other having aligned central passages of diameter slightly greater than the diameter of the lower bell so that the bell may be lowered to positions in which it will close the central passage through one or the other of the stock distributors, the apparatus serving to provide a central charging of the furnace by the passage of charging stock through the central passages of the frustoconical stock distributors when both bells are raised within the charging hopper, to provide a circumferential charging of the furnace when the lower bell is positioned within the central passage in the uppermost

stock distributor, and to provide an intermediate annular charge to the furnace when the lower bell is positioned within the central passage in the lower stock distributor.

2. An apparatus as claimed in claim 1 including two different hoisting means for providing movement of the lower bell, one of the hoisting means being adapted to accomplish the setting of the bell in positions below the bottom opening of the hopper and the other hoisting means being adapted to accomplish the upward movement of the bell above the bottom opening of the hopper.

3. An apparatus as claimed in claim 1 including lifting members for the bells arranged in spaced relation one within the other and including means through which cool gas may be blown into the space between the lifting members to prevent soot formation between the members and to cool the members.

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