

[54] **CHARGE DISTRIBUTING APPARATUS FOR BLAST FURNACES**

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[58] Field of Search ..214/18 V, 17 C, 23, 24, 35-37; 302/60; 239/666; 266/27; 193/31

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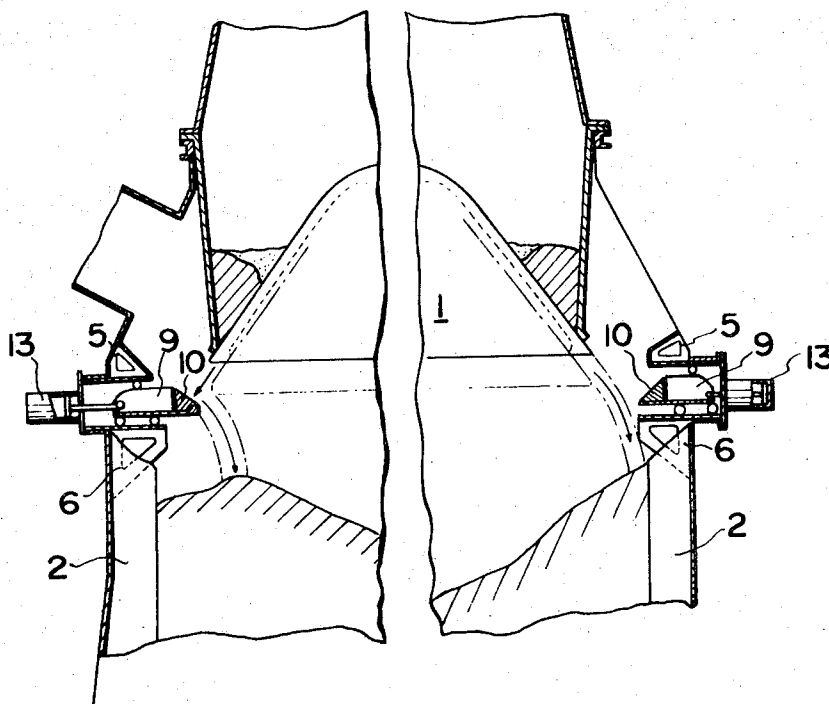
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[57] **ABSTRACT**

The charge distributing apparatus for blast furnaces comprises a charge distributing plate which is located below the lower bell and above the surface of the deposited charge and which is slanted at a predetermined angle, a guiding member to guide said distributing plate horizontally which is securely fixed to the blast furnace wall, and a driving system to drive said distributing plate back and forth along said guiding member. The distributing plate of the apparatus facilitates to shifting the position of charge disposal in a blast furnace, so that the surface of the deposited charge will be even.

28 Claims, 11 Drawing Figures



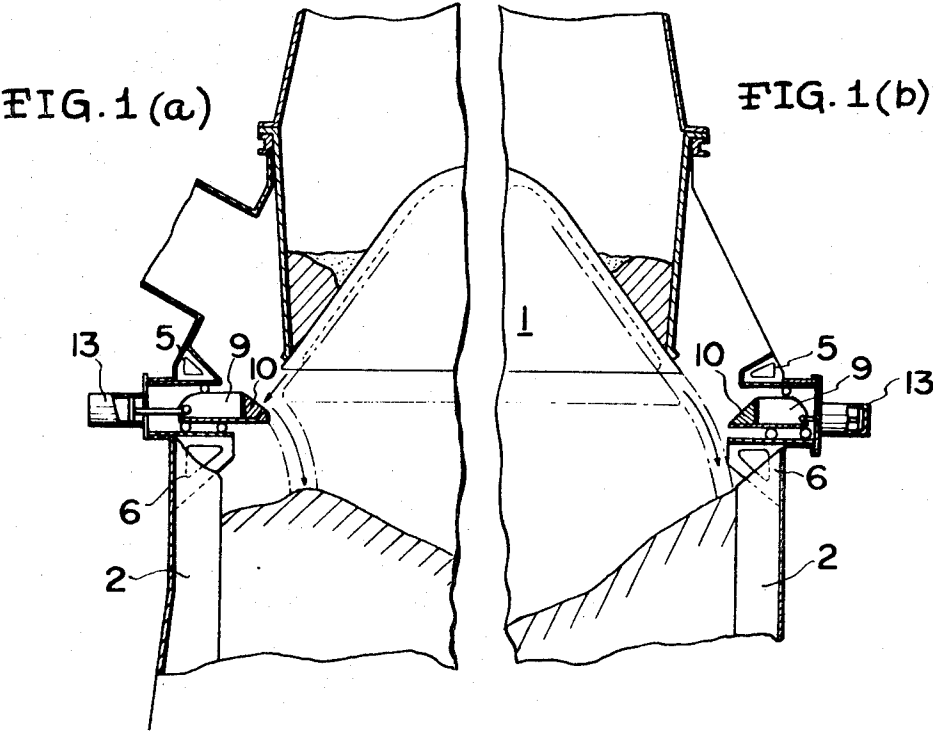


FIG. 3

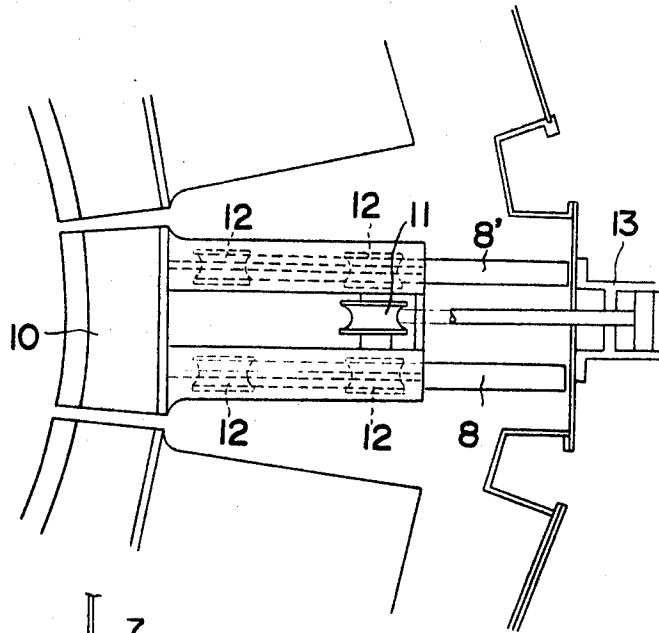
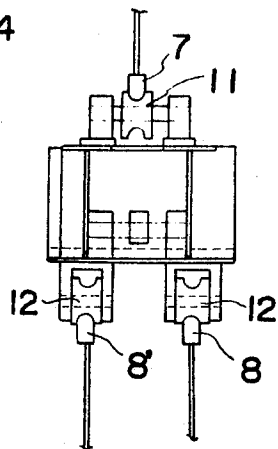
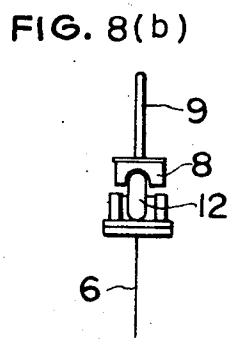
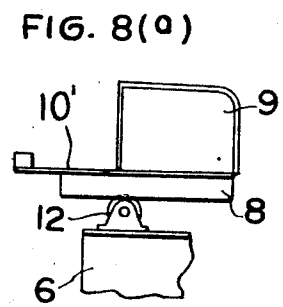
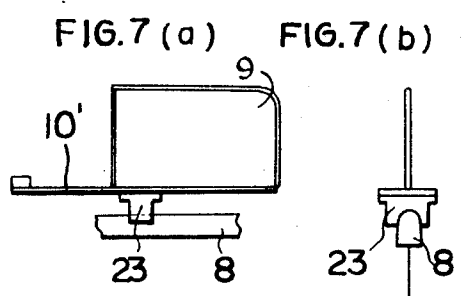
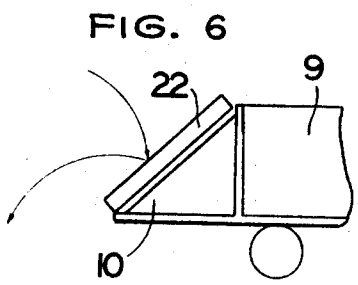
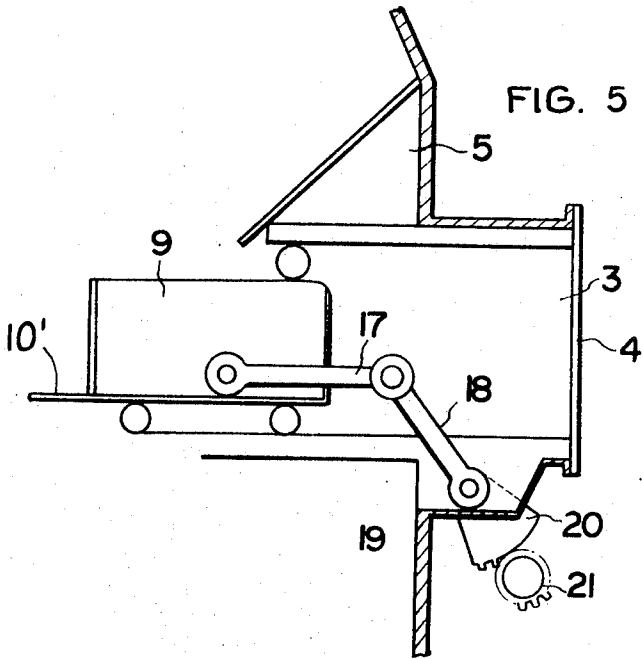


FIG. 4





CHARGE DISTRIBUTING APPARATUS FOR BLAST FURNACES

The present invention relates to a distribution apparatus for uniformly depositing charges such as iron ore, cokes, lime stone and the like into a blast furnace.

In a blast furnace having a large diameter shaft and which has a big capacity for charge such as ores, it is generally necessary to distribute and deposit said charge uniformly on the horizontal cross section of the blast furnace in order to carry out smooth operation. However, as the charge is generally introduced into the blast furnace through a big bell, the deposited charge would assume a conical shape, the middle portion and the portion adjacent the blast furnace wall being dented unless otherwise devised to prevent it; and it becomes difficult to obtain levelsurfaced charging.

Heretofore it has been proposed to gradually shift the position of charge distribution by the employment of a distributing plate either by changing the angle of the distributing plate suspended via a pin from the iron-shell of the blast furnace by a rod member which pushes the distributing plate at its lower end, or by vertically actuating the distributing plate suspended by means of a suspending rod and a ring girdle by a plate driving device provided at the blast furnace top.

However, these conventional apparatuses have various defects. The rotating member or suspending beam is easily damaged or bent because it is constantly exposed to the high temperature atmosphere in the blast furnace. It is extremely difficult or almost impossible to replace the distributing plate at an appropriate interval despite the fact that it is quite necessary because of the severe wear thereof caused by the impact of the charges. On the other hand, it would require installation of a complicated device to absorb said impact on the distributing plate, necessitating expenses and hinders smooth operation. Moreover, the installation of such a distributing plate would consume much space in the blast furnace.

The present invention has been developed in order to obviate above mentioned defects observed in the conventional apparatuses.

The present invention will now be described in detail with reference being made to the accompanying drawings in which:

FIGS. 1(a) and (b) are an explanatory diagram of a blast furnace top in cross-section;

FIG. 2 is a side view of a relevant part of the apparatus;

FIG. 3 is a plane view of FIG. 2;

FIG. 4 is a front view of FIG. 2;

FIG. 5 is a diagram showing the side view of a modification of the driving mechanism;

FIG. 6 is a partial side view of a distributing plate provided with a lining;

FIG. 7 shows another modified driving system, FIG. 7(a) being a diagram showing a side view thereof, and FIG. 7(b) being a diagram showing a front view; and

FIG. 8 shows still another modified driving system, FIG. 8(a) being a brief side view, and FIG. 8(b) being a brief front view.

In the drawings, corresponding elements in the various Figures are given the same reference numerals.

The reference numeral 1 represents a lower bell of a blast furnace, and 2 is a blast furnace wall. An opening

3, shown in FIG. 2, is formed at a position located below the lower bell 1 and above the line where the charge is deposited, said opening 3 having a diameter which is large enough to let the operator pass. The rear end portion of the opening 3 is covered by a removable cover 4 to keep it airtight. Upper and lower brackets 5 and 6 respectively are provided securely on the inner side of the blast furnace wall 2 adjacent the circumference of said opening 3. An upper rail 7, FIG. 2, is disposed horizontally below but adjacent said upper bracket 5, and a pair of lower rails 8, 8' are provided above but adjacent said lower bracket, in parallel with said upper rail 7. Said lower rails are so arranged to be symmetrical, with the upper rail being the center of the symmetry. 9 is a carrier, to which a distributing plate 10 being slanted at a suitable angle is attached at its forward portion. A wheel 11 is provided on the upper portion of the carrier 9 which engages with said upper rail 7. Four wheels 12, two on each side, are provided under the carrier 9 to engage with said lower rails 8, 8'. The carrier (9) is horizontally movable along the rails 7, 8 and 8'. It is desirable that the wheels 11 and (12) should be so designed as to well fit with the rails lest they should easily slip off therefrom, as shown in FIG. 4.

A driving system 13 secured adjacent said cover 4 comprises a cylinder 14 and a piston 15, and a piston rod 16 penetrates the cover 4 to connect with the rear of the carrier at its forward end, whereby the piston 15 actuated by suitably adjusted fluid pressure in the cylinder will drive the carrier 9 horizontally along the rails 7, 8 and 8'.

Said brackets 5, 6 should be disposed at a position where they will not come in contact with the charge. It is also desirable for the upper and lower brackets to be provided with heat resistant panels 5', 6' each at the upper and lower surfaces respectively in order to protect the movable part of the carrier from high temperature gas in the blast furnace. The distributing plate 10 may be provided with selflining at a portion which receives the impact of the charge, and with a replaceable lining at a portion which reaches inner most part of the blast furnace to give a longer life to the plate. Care should be taken in respect to the shape and the materials for the rails 7, 8 and 8' secured to the brackets 5, 6 so that neither high temperature gas in the blast furnace nor dust of the charge should accumulate thereon. It is still desirable to render said rails replaceable by employing generally used binding or mounting means.

The charge distributing apparatus of the above mentioned structure will be provided in a suitable number along the circumference of the blast furnace. Each of said charge distributing apparatus is actuated in accordance with a predetermined schedule, and one each alternatively will be driven to a predetermined position in the horizontal direction when the charge is dropped. FIG. 1(a) illustrates the distributing plate 10 when it is advanced furthestmost in the blast furnace. At this position, the charge introduced from the lower bell 1 will bump against the charge distributing plate 10 to alter its direction toward the center of the blast furnace where the charge is to be deposited. Thus, by shifting the position of the distributing plate backward from said most advanced position, the position of the charge disposal will concurrently be shifted from the center to

the wall of the blast furnace. When the distributing plate is completely rearward, as in FIG. 1(b), the charge will be deposited, without bumping against the plate, in the neighborhood of the blast furnace wall, whereupon level charging is completed. The impact imposed on the distributing plate 10 at the time of the charge disposal will be transmitted to the brackets 5, 6 via wheels 11, 12 and rails 7, 8, 8', and thus hardly to the driving system 13 so that there will be little chance to cause damage to the driving system. Repair and replacement of various parts can be carried out through the opening 3 by removing the cover 4, and the operator need not enter the blast furnace.

It should be noted that the driving system is not limited to such as aforementioned. For example, the carrier 9 may be driven by an arrangement comprising, as in FIG. 5, link 18 which is connected with the carrier by means of a connecting rod 17 which is connected to the carrier, a fan-shaped gear 20 which is connected securely to the shaft 19 of the link 18, a pinion 21 engaging with said gear, and a suitable power source actuating the rotation of said pinion. With this arrangement, it will be possible to drive a plurality of carriers by a single power source.

As is illustrated in FIG. 6, a replaceable resilient board (22) may be provided atop the upper face of the distributing plate 10 in order that the energy generated by the impact of the charge against the distributing plate may be utilized to increase the efficiency of the operation. Instead of the wheels 11, 12, gliding member 23 that is smaller in abrasive resistance may be used with the carrier (FIG. 7). It is also possible to attach the wheels 11, 12 on the brackets 5, 6 (FIG. 8).

In FIGS. 5, 7 and 8, the distributing plate is shown as being horizontal and is designated 10'.

The charge distributing apparatus for blast furnaces in accordance with the present invention comprises, as aforementioned, a charge distributing plate which is disposed at a position below the lower bell and above the deposited charge surface and which is slanted at an arbitrary angle, a guiding member to guide said distributing plate horizontally which is securely fixed to the blast furnace wall, and a driving system to drive said distributing plate back and forth along said guiding member. It offers various advantages: the distributing plate driven by the driving system horizontally along the guiding member will enable the position of the charge disposal in the blast furnace to shift, so that the surface of the deposited charge will be even; it is therefore unnecessary to provide a rotating member or a suspending beam of the conventional apparatuses for the distributing plate for the purpose of changing its angle, whereby the apparatus can be rendered of simple structure and yet solid; and effective use of the blast furnace space is assured because not much space is required for the installation of the distributing plate.

What we claim:

1. A charge distributing apparatus for blast furnaces enclosed by a wall and having a lower bell located above the surface of the deposited charge, comprising:
a horizontally movable charge distributing plate which is located below the lower bell and above the surface of the deposited charge and which is inclined at a predetermined angle;

a guiding member fixed to the blast furnace wall for guiding said distributing plate horizontally and relative to the blast furnace wall; and

a driving system coupled to said distributing plate for reciprocally driving said distributing plate back and forth along said guiding member during the charging of said furnace the charge dropping from said lower bell onto said distributing plate during movement thereof and being deflected by said distributing plate to deposit said charge in said furnace with a given surface configuration.

2. Apparatus according to claim 1 wherein said charge distributing plate is mounted on a carrier which is movably engaged with said guiding member.

3. Apparatus according to claim 2 wherein said guiding member comprises a plurality of tracks, and wherein said carrier includes a plurality of wheels engaging said tracks.

4. Apparatus according to claim 3 comprising at least two tracks located below said carrier and at least one track located above said carrier, said carrier including means engaging said tracks.

5. Apparatus according to claim 2 wherein said carrier is slidable on said guiding member.

6. Apparatus according to claim 2 wherein said carrier includes a sliding lower surface, and wherein said guiding member includes a plurality of wheels on which said sliding lower surface rides.

7. Apparatus according to claim 1 wherein said charged distributing plate has a resilient surface.

8. Apparatus according to claim 1 wherein said charged distributing plate has a replaceable surface.

9. Apparatus according to claim 1 wherein said driving system comprises a fluid pressure system including a cylinder having a movable piston therein, said movable piston being coupled to said charge distributing plate.

10. Apparatus according to claim 1 wherein said drive system includes a drive element, and a mechanical gear and link system coupling said drive element to said charge distributing plate.

11. Apparatus according to claim 1 comprising a plurality of charge distributing plates located around the circumference of said blast furnace, a plurality of guiding members respectively guiding said charge distributing plates, and a drive system coupled to said distributing plates for reciprocally driving same.

12. Apparatus according to claim 11 comprising a common driving system coupled to all of said distributing plates.

13. Apparatus according to claim 12 wherein said common drive system comprises a common driving gear, and a plurality of additional gears and links respectively coupling said common drive gear to said plurality of distributing plates.

14. Apparatus according to claim 1 wherein said distributing plate is moved by said driving means to provide a uniform charge distribution in said furnace.

15. Apparatus according to claim 1 wherein said charge distributing plate is a substantially flat plate.

16. Apparatus according to claim 1 wherein said charge distributing plate is horizontally movable out of the path of the charge dropping from said lower bell.

17. A charge distributing apparatus for blast furnaces enclosed by a wall and having a lower bell located above the surface of the deposited charge, comprising:

a horizontally movable distributing plate which is located below the lower bell and above the surface of the deposited charge;

a guiding member fixed to the blast furnace wall for guiding said distributing plate horizontally and relative to the blast furnace wall; and

a driving system coupled to said distributing plate for reciprocally driving said distributing plate back and forth along said guiding member during the charging of said furnace, the charge dropping from said lower bell onto said distributing plate during movement thereof and being deflected to deposit said charge in said furnace with a given surface configuration.

18. Apparatus according to claim 17 wherein said charge distributing plate is generally horizontal, some of said dropping charge accumulating on said charge distributing plate, and the remainder dropping charge deflecting off of said accumulator charge to deposit said charge in said furnace with said given surface configuration.

19. Apparatus according to claim 18 wherein said charge accumulated on said charge distributing plate forms an inclined surface.

20. Apparatus according to claim 17 wherein said charge distributing plate is horizontally movable out of the path of the charge dropping from said lower bell.

21. Apparatus according to claim 17 wherein said charge distributing plate is mounted on a carrier which is movably engaged with said guiding member.

22. Apparatus according to claim 21 wherein said guiding member comprises a plurality of tracks, and wherein said carrier includes a plurality of wheels engaging said tracks.

23. Apparatus according to claim 22 comprising at least two tracks located below said carrier and at least one track located above said carrier, said carrier including means engaging said tracks.

24. Apparatus according to claim 21 wherein said carrier is slidable on said guiding member.

25. Apparatus according to claim 17 wherein said driving system comprises a fluid pressure system including a cylinder having a movable piston therein, said movable piston being coupled to said charge distributing plate.

26. Apparatus according to claim 17 wherein said drive system includes a drive element, and a mechanical gear and link system coupling said drive element to said charge distributing plate.

27. Apparatus according to claim 17 comprising a plurality of charge distributing plates located around the circumference of said blast furnace, a plurality of guiding members respectively guiding said charge distributing plates, and a drive system coupled to said distributing plates for reciprocally driving same.

28. Apparatus according to claim 27 comprising a common driving system coupled to all of said distributing plates.

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