Nov. 20, 1962 K. BECKENBACH 3,064,960

APPARATUS FOR REMOVING BURNT OR CALCINED MATERIAL FROM FURNACES

Filed April 26, 1961 3 Sheets-Sheet 1

Fig.1

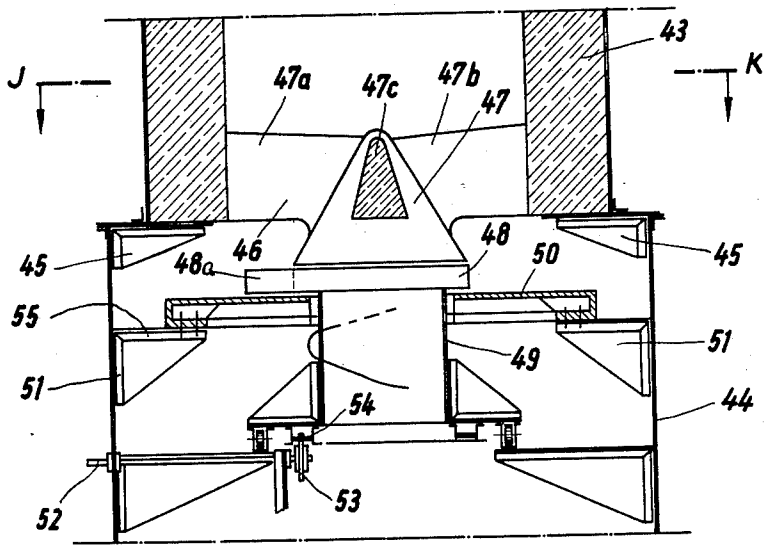
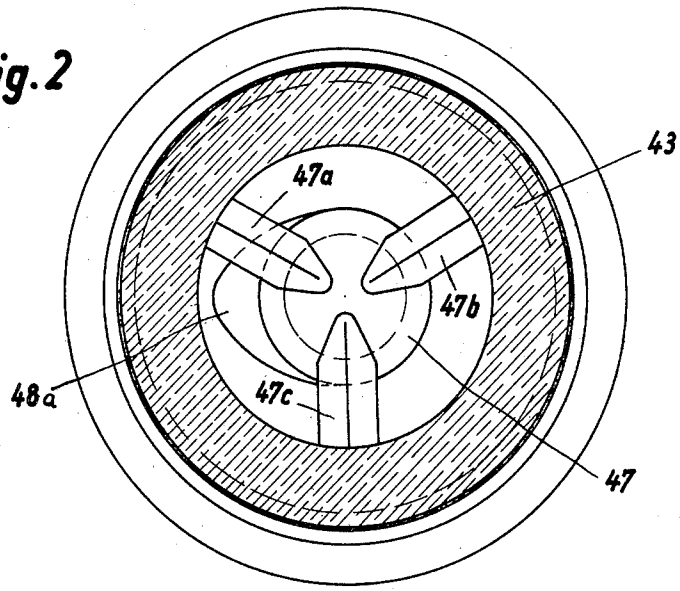


Fig.2



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Fig.3

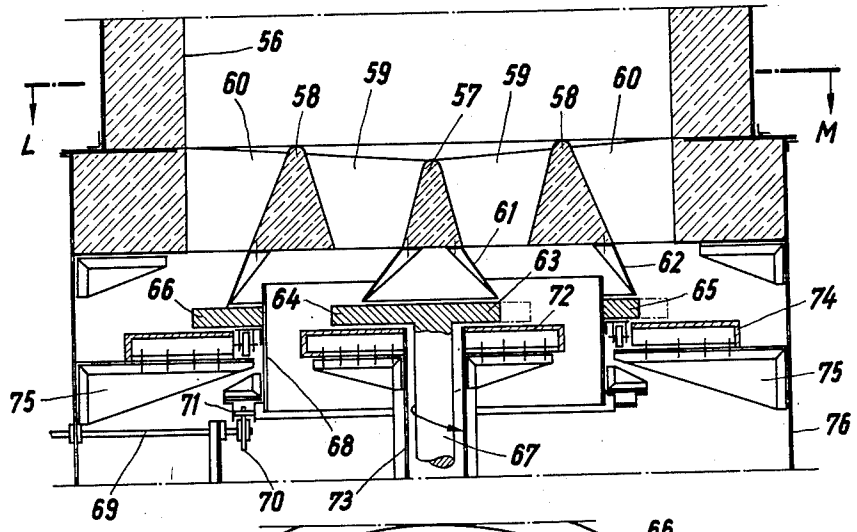
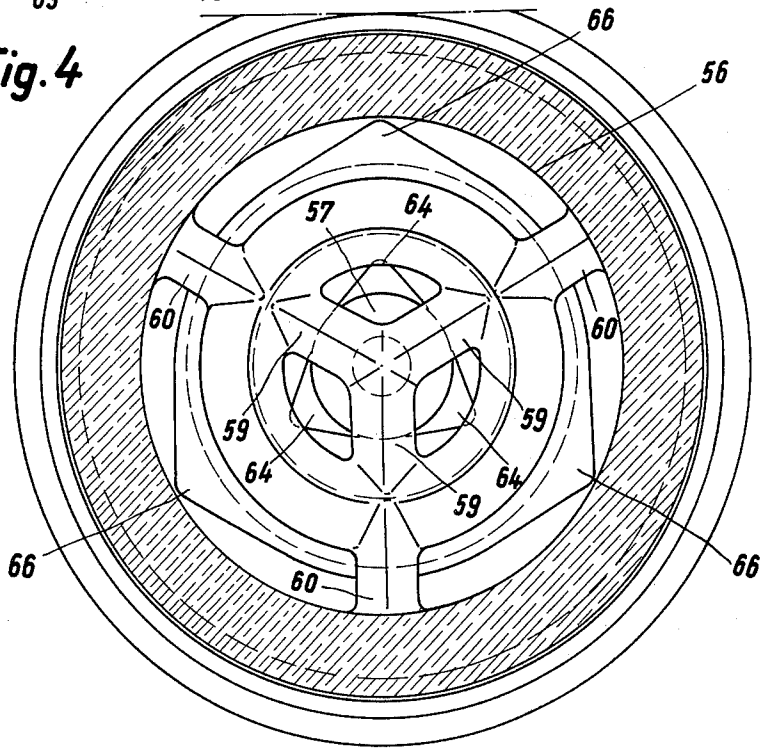


Fig.4



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Fig. 5

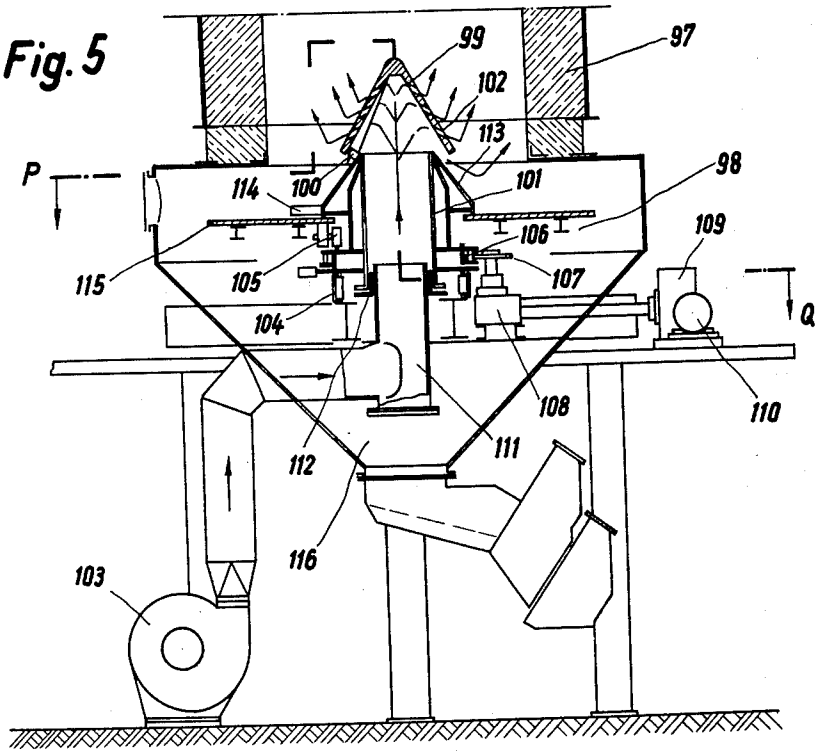
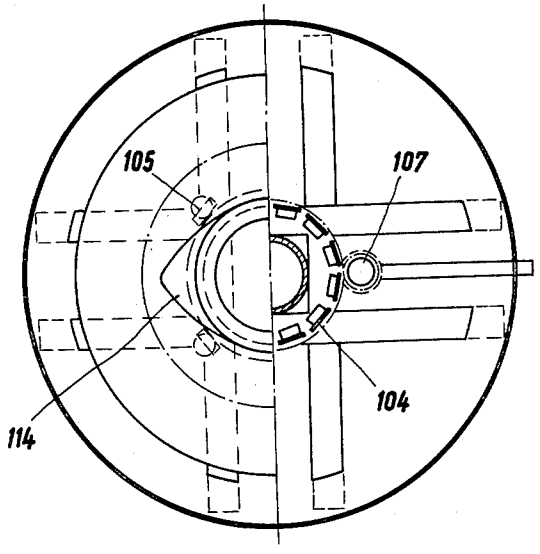


Fig. 6



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3,064,960
APPARATUS FOR REMOVING BURNT OR CALCINED MATERIAL FROM FURNACES

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This invention relates to an apparatus for removing a burnt or calcined material in pieces, such as limestone, dolomite, ore, or the like from shaft furnaces.

This removal of piece-form material from the lower end of the furnace is rendered difficult by the tall column of material which fills the shaft furnace and which bears on the floor of the latter. This load is particularly troublesome if the intention is to engage the material over the full cross section of the shaft furnace so that the column of material in the latter sinks uniformly.

It has further been found that the quality of the extracted piece-form material, under the permanent load of the tall column of material, is impaired by the fact that it is not uniformly compressed and as a consequence is unfavorably affected. In the calcination of limestone it is desirable to secure a product of uniformly porous quality in which the original piece size is retained as far as possible. These characteristics can only be incompletely achieved when prior known discharge devices are used.

It is an object of the invention to provide a form of apparatus for discharging material in piece form from shaft furnaces which allows for a uniform discharge of the material without unduly crushing the material.

In accordance with the invention the discharge of material is brought about with the assistance of one respectively of several rotatably mounted discharging members which are movable over a corresponding number of base plate members and can be driven by a driving means either so as to oscillate, that is to say to reciprocate pivotally through a predetermined angle, or to rotate continuously.

The discharging members are arranged below distributing bodies of substantially conical cross section and are provided at their outer periphery with one or more cam-shaped projections which project over the lower periphery of said distributing bodies which carry the weight of the material.

Contrary to known bar-shaped discharging devices which deeply extend into the material supported on the base plate and which during their rotating movement push the material in circumferential direction over the base plate before it is discharged over the periphery of said plate, the novel discharging means urges the material substantially radially outwardly beyond the edge of the base plate with the to be discharged material being substantially relieved from the weight of the material column and being discharged in uncrushed condition.

The distributor body can be rigidly fastened to the furnace structure so that merely the protruding camming section of the discharge device is subjected to the weight of the material.

If the furnace is of large cross section concentrically disposed arrangements of several distributor bodies, discharging members and base plates can be provided; with the distributor bodies comprising a central conical body and an annular body of conical cross section concentrically spaced from said conical body, both bodies being connected to the furnace structure by substantially radially extending ribs; the discharging members comprising a central member and an annular disc spaced from the central member with both members being provided each with at least one cam-portion projecting beyond the respective distributor body.

Particularly for short shaft furnaces, serving for preheating material subsequently to be treated in rotary furnaces and for sintering, the conical distributor body can be rigidly connected with the discharging member. In a preferably used modification of this arrangement a hood-like conical distributor body provided with air outlet openings in its conical surface is connected with a rotatable tubular body communicating with a blower, the discharging means being rigidly connected to this tubular body and comprising for instance a conical skirt connected to the tubular body below said hood-like distributor body and being provided with at least one cam-like projection for pushing the finished material over the outer edge of an annular base plate surrounding said tubular body.

A number of embodiments of a discharge apparatus constructed in accordance with the present invention are illustrated diagrammatically and by way of example.

FIGURE 1 is a vertical section through the lower end of a shaft furnace showing a camming discharge mechanism constructed in accordance with an embodiment of the invention;

FIGURE 2 is a section on the line J—K of FIGURE 1;

FIGURE 3 illustrates, likewise in vertical section, the discharge openings of a shaft furnace of large diameter and a construction of the discharge apparatus with a plurality of concentric and driven discharge knockers;

FIGURE 4 is a section on the line L—M of FIGURE 3;

FIGURE 5 shows a further and modified form of knocker discharge apparatus used in a shaft furnace, this view being partly in elevation and partly in vertical section; and

FIGURE 6 is a plan view on the line P—Q of FIGURE 5, partly in section.

Illustrated in FIGURES 1 to 6 are various embodiments of the invention in which the material is urged into slots located at the outer periphery of plate members by a relative rotary movement between the plate members supporting the material and the discharge members.

The wall of the furnace shaft is designated 43 in FIGURES 1 and 2, and the lower structure of the furnace is surrounded by a cylindrical casing 44 provided with brackets 45 which sustain the weight of the masonry. A conical distributor body 47 projects into the bottom opening 46 of the shaft furnace, this body being stationary and being connected to the wall 43 of the furnace by means of lateral ribs 47*a*, 47*b*, 47*c* which are of saddle shape in cross section.

A discharge means 48 rotatable about the central axis of the furnace is arranged beneath the distributor body 47 and is driven from below by a shaft, for example in the form of a hollow cylinder 49, and continuously rotated. The discharge means 48 which is a disc-like body having a cam portion 48*a* turns over a bottom plate 50, which is, for example, supported on brackets 51 and is firmly connected thereto, for instance by screws. The drive shaft 49 passes through a central opening in the fixed bottom plate 50.

The cylinder 49 is driven, for example by means of a shaft 52 projecting in from the exterior, through suitable gearing elements 53, 54. These elements may, for example, be in the form of a driving wheel having teeth engaging with a pinion rigidly connected to the cylinder 49. When the discharge means 48 rotates, the piece-form material disposed on the bottom plate 50 is forced outwards by cam action to drop over the edge of the bottom plate into the peripheral slots 55.

As will be seen from FIGURES 3 and 4, a conical distributor body 57 which projects into the center of the discharge opening of the furnace shaft 56, and an annular distributor body 58 surrounding the latter are arranged inside this opening. These distributor bodies

are firmly connected by ribs 59, 60 to one another and to the wall 56 of the furnace. The distributing surface thereof is extended by sheet metal casings 61 and 62 connected thereto.

Beneath the central distributor cone and the outer distributor ring are movable discharge devices, namely a circular discharge means 63 with cam projection 64 and an annular discharge means 65 in form of a plate provided with cam projections 66.

Discharge means 63 is driven by a vertical shaft 67 extending below the same. The annular discharge plate 65 is connected to a cylinder 68 which can be rotated by a shaft 69, protruding in from the exterior, through the agency of gearing elements 70, 71.

Disposed beneath the circular rotary discharge plate 63 is a distributor table 72 which is rigidly connected to the bottom structure 73 of the furnace, while beneath the rotary discharge ring 65, 66 is an annular table 74 which is firmly connected to the outer casing 76 of the bottom structure of the furnace by brackets 75.

In FIGURES 5 and 6 reference numeral 97 designates the lower part of a shaft furnace with a discharging device 112 and a conical distributor body 99 which is detachably connected to the rotatable air feed pipe 101 by means of three or more ties or lugs 100. The surface of the distributor cone has a number of holes or slots 102 through which the air delivered by a blower 103 can flow into the furnace shaft to serve as combustion air. The rotatable air feed pipe 101 is supported on the carrier assembly of the furnace bottom structure through bearing rollers 104 and guide rollers 105, and is operated by means of a pinion 106 and a spur gear 107 via an interposed gearing 108, 109 from the motor 110. The movable part 101 is sealed relatively to the fixed part 111 of the air feed pipe by a packing gland 112. Rigidly connected to the rotatable air feed pipe 101 is a further conical distributor body 113 with a discharge cam projection 114 which pushes the burnt or sintered material over the table 115. This material then passes through the hopper-form discharge container to the discharge means 116.

The various arrangements described can be modified in many ways within the scope of the substantial principles of the present invention. In particular, for example, the construction of the distributor table and that of the driving means can be varied to a very wide degree. The distributor table, for example, can be made with a conical surface instead of being flat, as for example is the case with the rotary or fixed distributor ring according to FIGURES 5 and 6.

I claim:

1. In an apparatus for removing burnt and calcined material in piece form such as limestone, dolomite or the like from shaft furnaces which are of circular cross-section at least at their lower portion and are provided with a discharge opening, plate means fixedly connected to the furnace structure and disposed centrally at the circular discharge end of the furnace and adapted to support the material to be discharged; discharge means disposed adjacent said discharge opening so as to extend partially above the surface of said plate means and to extend in a radial direction, said discharge means including a substantially disc-shaped body mounted for rotation about the axis of said furnace and provided at its outer periphery with at least one radially extending cam-shaped projection for engaging and urging the material from said plate means in a direction substantially radially and outwardly to be discharged in an uncrushed condition over the outer periphery of said plate means; and a material distributing body connected to the furnace structure and mounted in the center of the furnace in the discharge thereof and above said discharge means, the lower circumference of said distributing body covering said discharge means with the cam shaped projection extending radially beyond the lower circumference thereof.

2. In an apparatus for removing burnt or calcined material in piece form such as limestone, dolomite and the like from shaft furnaces which are of circular cross-section at least at their lower portion and are provided with a discharge end, plate means rigidly connected to the furnace structure and disposed centrally at the discharge end of the furnace adapted to support the material to be discharged; discharge means arranged to extend partially above the surface of said plate means and in a radial direction, said discharge means being rotatable about the axis of said furnace, at least one radially extending cam-shaped projection on said discharge means to urge the material to be discharged from said plate means in a direction substantially radially outwardly to be discharged in an uncrushed condition over the outer periphery of said plate means, said discharge means being connected to and driven by a rotatable air feed pipe in sealed communication with the stationary pipe of a blower, a conical hood-like distributor body of conical shape secured to the upper discharge end of said feed pipe above said discharge means, said conical body being provided with air outlet openings.

3. In apparatus for removing burnt or calcined material in piece-form, such for example as limestone, dolomite, ore or the like from shaft furnaces which are of circular cross section, at least at their lower part, two concentric annular plate means spaced substantially radially relative to one another and fixedly connected to the furnace structure being disposed concentrically to the furnace axis at the discharge end of the furnace for supporting the material to be discharged; two discharge means disposed so as to extend partially above said plate means and mounted so as to be rotatable about the axis of said furnace, both discharge means being provided at their outer periphery with at least one cam-shaped projection for urging the to be discharged material supported on said plate means outwardly to be discharged in uncrushed condition over the outer periphery of said plate means, the inner one of said discharge means being disposed at the center of this furnace and the outer discharge means being an annular member disposed substantially radially outwardly from the inner discharge means at a substantial distance therefrom and in concentric relation thereto; a material distributing body of substantially conical shape being mounted in the center of the furnace above said inner discharge means, an annular distributing body of substantially cone-shaped cross section being disposed concentric to said cone-shaped distributing body in spaced relationship thereto above said outer discharge means, the lower outer circumference of both said distributing bodies being of such size that substantially only said cam-shaped projections protrude radially beyond said lower circumference.

References Cited in the file of this patent

UNITED STATES PATENTS

399,795	Taylor	Mar. 19, 1889
999,698	Chapman	Aug. 1, 1911