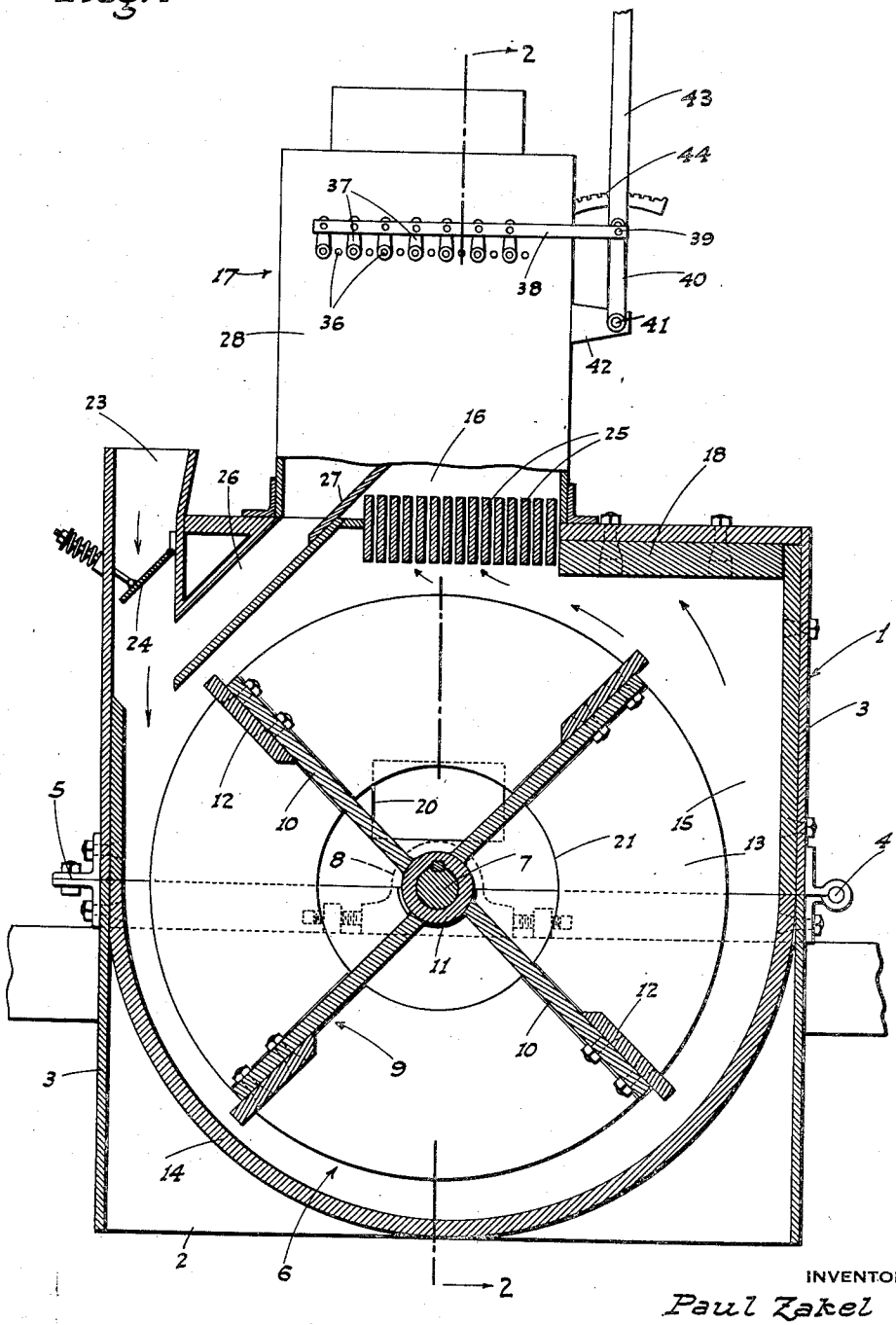
March 27, 1951 P. ZAKEL 2,546,286

ROTARY BEATER MILL WITH IMPERFORATE CONCAVES, VERTICAL BAFFLED DISCHARGE, UPPER ANVIL PLATE, AND AIR AND MATERIAL INLETS

Filed June 28, 1947

3 Sheets-Sheet 1

Fig. 1



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Filed June 28, 1947 3 Sheets-Sheet 2

Fig. 2

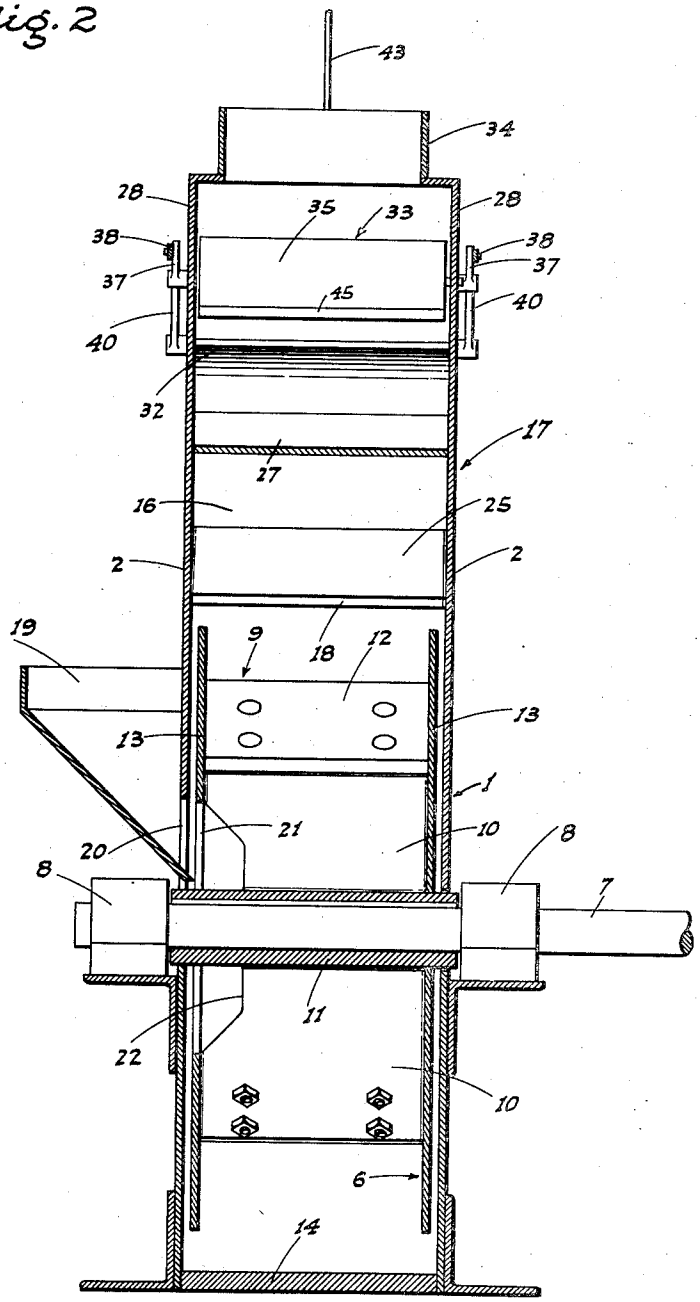

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Fig. 3

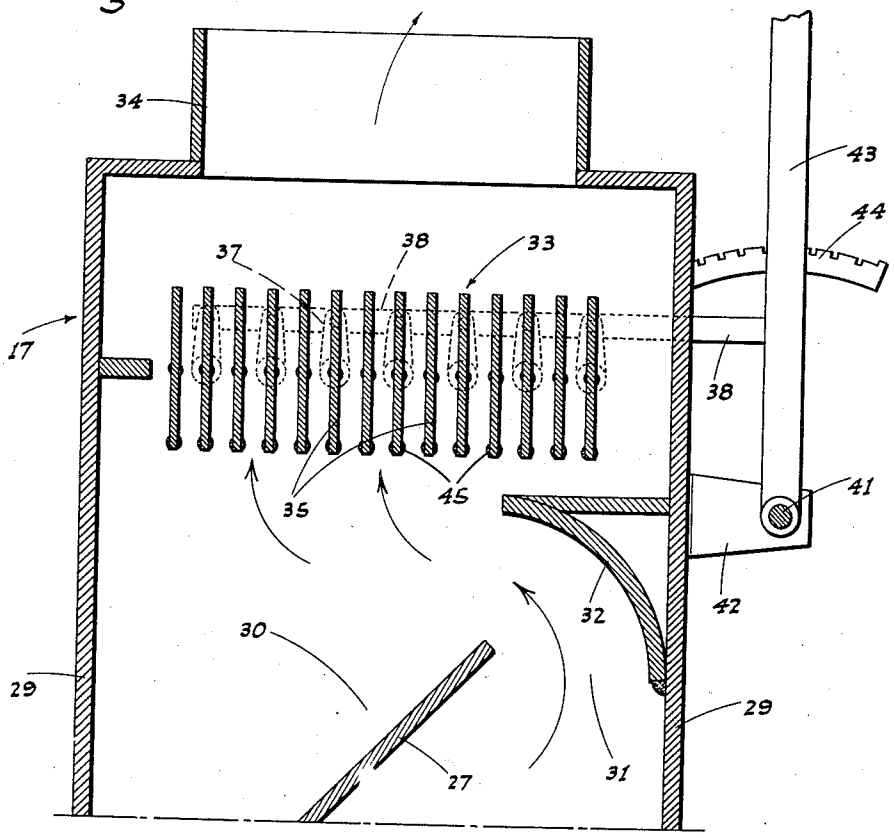
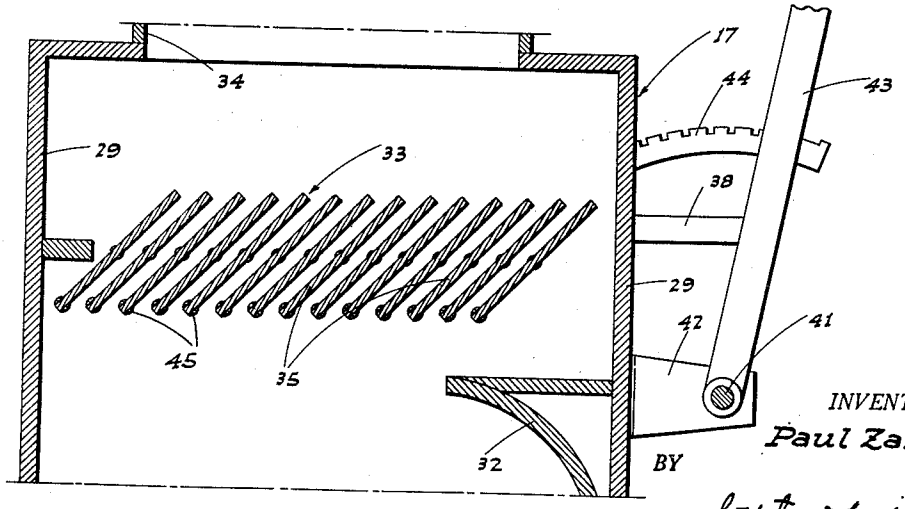


Fig. 4



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ROTARY BEATER MILL WITH IMPERFORATE CONCAVES, VERTICAL BAFFLED DISCHARGE, UPPER ANVIL PLATE, AND AIR AND MATERIAL INLETS

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Application June 28, 1947, Serial No. 757,879

7 Claims. (Cl. 241—50)

1

The object of the invention is to provide an ore reduction mill which includes a novel arrangement of rotary beater bars and a stationary breaking plate and anvil, together with an automatic air intake, a return chute leading from a classifier into the mill, and a side feed mechanism for feeding material to the beater bars, all so arranged in such relative combination of said parts as to provide a highly efficient mill.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a side elevation of the ore reduction mill, mainly in section.

Fig. 2 is a cross section on line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary sectional elevation showing the classifier assembly in one position of adjustment.

Fig. 4 is a similar view, but shows the classifier assembly in another position of adjustment.

Referring now more particularly to the characters of reference on the drawings, the improved ore reduction mill comprises a housing, indicated generally at 1. The housing 1 includes transversely spaced side plates 2 and end walls 3; such housing being split horizontally at a substantially central point and hinged together, as at 4, for opening movement of the top half whereby to provide access into said housing for repair or replacement of the parts therein. The housing halves are normally maintained against opening movement by a flange 5 mounted in connection with the end wall 3 opposite the hinge 4.

A heavy-duty rotor, indicated generally at 6, is mounted in the housing 1, for rotation, on a transverse horizontal shaft 7 which projects through the side plate 2 and is carried externally thereof in bearings 8. At one end the shaft is driven by any suitable means (not shown), such as an electric motor and reduction gear unit.

The rotor 6 includes a spider, indicated generally at 9, the legs of which are in the form of flat blades 10 mounted on a hub 11, and facing in the direction of rotation. At their outer ends the blades 10 each carry a transverse beater blade 12 of wear resistant steel. At the ends of the rotor the blades 10 are fixed in connection with end discs 13, which impart rigidity to the rotor and run in relatively close relation to corresponding side plates 2.

A breaking plate 14 is mounted in the housing

2

1 in surrounding relation to the rotor except for the top portion of the latter; such breaking plate being fixed at one end in connection with the corresponding end wall 3; thence extending downwardly and about the bottom of the rotor; and thence extending up the opposite end wall to adjacent the top thereof. The arcuate configuration of the breaking plate 14 is such that the distance between the periphery of the rotor and said plate gradually increases in the direction of rotation. The reduction chamber formed by the breaking plate 14 and the side plates 2 is indicated generally at 15. The transverse beater blades 12 are removably mounted on the spider legs or fan blades 10, and normally project slightly beyond the periphery of the rotor for effective ore engagement and impelling through the reduction chamber 15.

At the top, substantially centrally thereof, the housing 1 is in communication with an upwardly extending throat 16 formed by an upstanding classifier box, indicated generally at 17, which will be hereinafter described in greater detail as to its structure and function.

An anvil plate 18 is mounted in the housing 1, at the top thereof, generally tangential to the rotor and in a position directly above the upturning side of such rotor. As so mounted the anvil plate 18 is disposed ahead of the throat 16 in a direction contra to the direction of rotor movement.

A feed chute 19 is mounted on one side plate 2 above the shaft 7, and delivers through an opening 20 in said side plate; the corresponding end disc 13 of the rotor having an annular opening 21 running in register with the opening 20 so that ore from the chute 19 may pass through openings 20 and 21 into the rotor between the blades 10; the latter being cut away adjacent the opening 21, as at 22, to prevent choking of ore delivery to the rotor.

Once in the rotor, which is turned at substantial speed, the ore is impelled about in a generally circular path by the blades 10, and particularly by the beater blades 12 thereon. As the ore runs against the breaking plate 14 it is gradually reduced in size, and additionally on the upward path of its motion such ore is cast, by the plates 10 and 12, against the anvil plate 18, causing disintegration or reduction of such ore.

As the rotor 6 is traveling at substantial speed there is a tendency to create a suction in the reduction chamber 15, which suction is effective in an air inlet passage 23 leading downwardly

through the top of the housing 1 adjacent the end opposite the anvil plate 18; there being a suction-opened, spring-closed valve unit 24 associated with the air inlet passage 23. When the mill is running, the valve unit 24 will automatically open to permit of air entry into the reduction chamber 15 as working conditions may require; otherwise preventing escape of reduced ore from the mill.

Within the lower end thereof the throat 16 of the upstanding classifier box 17 is fitted with a grate or fixed bank of baffle plates 25; these baffle plates being flat, of substantial height, and disposed in a row between the side plates 2 in closely spaced, facing relation.

A return chute 26 leads into the reduction chamber 15 at a point directly below the air inlet passage 23, which of course is at the end of the mill opposite the anvil plate 18. The return chute 26 includes a baffle plate 27 extending at an upward incline within the classifier box 17 between the side walls 28 thereof, and forming, with one end wall 29 of such box, a hopper 30. The baffle plate 27 terminates, at its upper end, in spaced relation to the opposite end wall 29 whereby to provide an upward air flow passage 31 above the fixed bank of baffle plates 25.

At the upper end of passage 31, the air flow is delivered against an arcuate baffle 32 on said opposite side wall 29 curving upwardly and inwardly whereby to divert air flow from passage 31 directly over the hopper 30. Thence, the air flow turns and travels upwardly through an adjustable classifier unit, indicated generally at 33, finally flowing or passing out of the mill through a top outlet neck 34.

When the mill is in operation, the ore which has been reduced to very fine particles, or dust, is carried, by the air stream, through the fixed bank of baffle plates 25, and flows upwardly in the passage 31, whence it is deflected by baffle 32 directly over the hopper 30. The large and unreduced pieces of ore are separated from the air stream by the bank of baffle plates 25, but the spacing of these plates is such that they effect merely an initial rough separation, and some pieces of ore of too large size continue upwardly in the air stream in passage 31. However, these too large pieces of ore are separated by the adjustable classifier unit 33, in the manner which will hereinafter appear, and fall downwardly into the hopper 30 and return into the reduction chamber through the chute 26 for further reduction. The stream of air, laden with the reduced ore dust, flows out of the mill through the top outlet neck 34 to a cyclone or the like for recovery of the dust and subsequent processing thereof to recover its mineral content.

The adjustable classifier unit 33 is constructed and operates as follows:

The adjustable classifier unit 33 includes a plurality of flat plates 35 of substantial height extending horizontally across the classifier box 17 between the side walls 28 thereof; said plates 35 being disposed in relatively closely spaced, parallel facing relation. At opposite ends, substantially centrally of their upper and lower edges, the plates 35 include trunnion pins 36 which extend through the side walls 28 in supporting relation to said plates. At opposite sides of the classifier box 17 alternate trunnion pins 36 are fitted with upstanding radial arms 37; this alternate arrangement being necessary because of the close spacing of the plates 35. The row of radial arms 37 on each side of the classifier box 17 are pivotally connected to a control link 38 for swinging movement in unison, while maintaining the parallelism of the plates 35. The control links 38 extend beyond one end of the classifier box and are pivotally connected, as at 39, with the upper end of radial levers 40 on a cross shaft 41 journaled in supporting brackets 42. The cross shaft 41 includes, centrally thereof, an upstanding hand lever 43 normally maintained in selective position by adjustment by releasably latching the same to a notched quadrant 44. With this arrangement, swinging of the hand lever 43 simultaneously actuates the control links 38 and causes corresponding adjustment of all of the baffle plates 35 in the bank which comprises the classifier unit 33. It is possible to adjust the angular relationship of the plates 35 from vertical, as in Fig. 3, to a sharp angle, as in Fig. 4.

As will be evident, adjustment of the baffle plates 35, from their vertical position to an angular position, causes a reduction in the velocity of the air stream flowing through the classifier box 17, with the result that greater precipitation of the larger dust particles in such air stream is accomplished. It is therefore possible to regulate, accurately, the classification of the reduced ore or dust which ultimately delivers from the mill through the top outlet neck 34. As previously explained, all dust particles or ore pieces which are classified out by the unit 33 can only fall into the hopper 30 for return into the mill for further reduction. The described ore reduction mill provides, in its structural assembly, effective and practical reduction means, coupled with a classifier assembly which permits of close control of the screen size of the dust which delivers from the mill outlet; both features being valuable to the effective, practical, and economical operation of a mill of this character.

The lower edges of the baffle plates 35 are each formed with an enlarged rib or bead therealong, as at 45; such beads being rounded in cross section and of wear resistant material. The beads 45 assure of better classification of the reduced ore passing therebetween, and additionally prevent jamming of reduced ore pieces between the plates 35 as any pieces which pass between adjacent enlarged beads can, of course, then pass between corresponding plates.

From the foregoing description it will be readily seen that there has been produced such a device as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. An ore reduction mill comprising a housing including spaced side plates and a front end wall and a back end wall connecting the side plates and a top, said top being flat in a horizontal plane and provided with an outlet disposed substantially centrally of said top, a rotor including circumferentially spaced beater bars, such rotor being supported in the housing transversely between the side plates, a breaking plate in the housing disposed transversely across the housing between the side plates, such breaking plate hav-

ing an arcuate portion disposed about and spaced from the rotor below the horizontal axis of such rotor and also having a vertical portion disposed in parallelism with the back wall of the housing, an anvil plate fixed to the top wall of the housing and extending between the upper end of the vertical portion of the breaking plate and the outlet, and having a horizontal flat under face opposed to the direction of rotation of the rotor, and means for delivering material into the housing into the path of the rotor.

2. An ore mill as in claim 1 in which the axis of the rotor is disposed eccentrically of the axis of the arcuate portion of the breaking plate in a direction toward the front wall of the housing whereby the space between the rotor and breaking plate gradually increases in size in a direction toward the anvil.

3. An ore mill as in claim 1 including a plurality of vertically disposed baffle plates fixed in said opening forwardly of the inner end of the anvil plate.

4. An ore mill as in claim 1 including a vertically disposed air inlet opening into the housing adjacent the front wall, the rotor including fan blades, whereby with the turning of the rotor an air stream is drawn through said air inlet and carried through the housing and discharged through the outlet.

5. An ore reduction mill comprising a substantially rectangular housing having an ore feed opening and a separate reduced ore outlet, a driven rotor journaled in the housing on a horizontal axis, an arcuate breaking plate in the housing surrounding substantially the lower half portion of the rotor to form a reduction chamber, an anvil disposed in the top of the housing on that side of such top which is opposed to the direction of movement of the rotor, such anvil having a horizontal under face which lies in a plane substantially tangent to the upper side of the rotor and the reduced-ore outlet lying adjacent the inner edge of the anvil and above the rotor; and a classifying grate disposed in said outlet, said grate comprising a plurality of flat baffle plates disposed on edge in closely spaced face to face relation; the lower edges of the plates lying closely adjacent the horizontal plane of the under face of the anvil.

6. An ore reduction mill comprising an enclosed housing which includes spaced side plates, a front end wall and a back end wall connecting

the side plates, and a top provided with an outlet, a horizontal shaft journaled in the housing transversely of the side plates, a disc on the shaft adjacent each side plate, vanes disposed transversely of and between the discs, such vanes being fixed to the shaft and projecting radially out therefrom to points adjacent the outer peripheries of the discs, one disc being provided with an opening in its face disposed concentric with the shaft, the side plate of the housing adjacent said last named disc being provided with an opening in communication with the opening in the disc, a material supply chute disposed in communication with the openings in the said side plate and disc, and a breaking plate and anvil assembly disposed within the housing in co-operative relation with the vanes and effective to act on material fed through said openings.

7. A mill as in claim 6 in which each vane is cut out for a distance inwardly from that portion of its edge which lies contiguous to the opening in the face of said one disc.

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