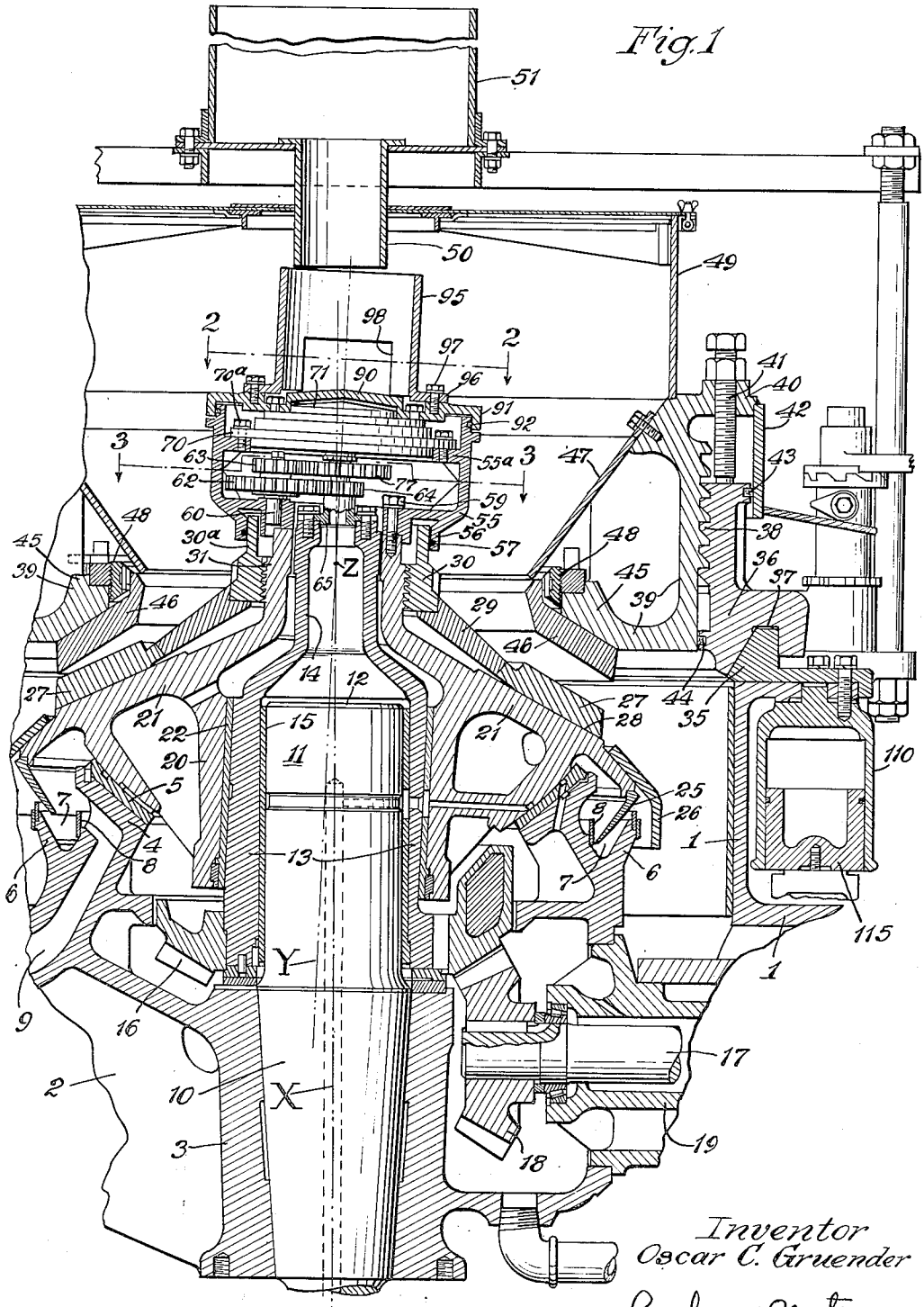
Dec. 16, 1952 O. C. GRUENDER 2,621,860

FEED PLATE FOR GYRATORY CRUSHERS

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Fig. 1



Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys.

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Fig. 2

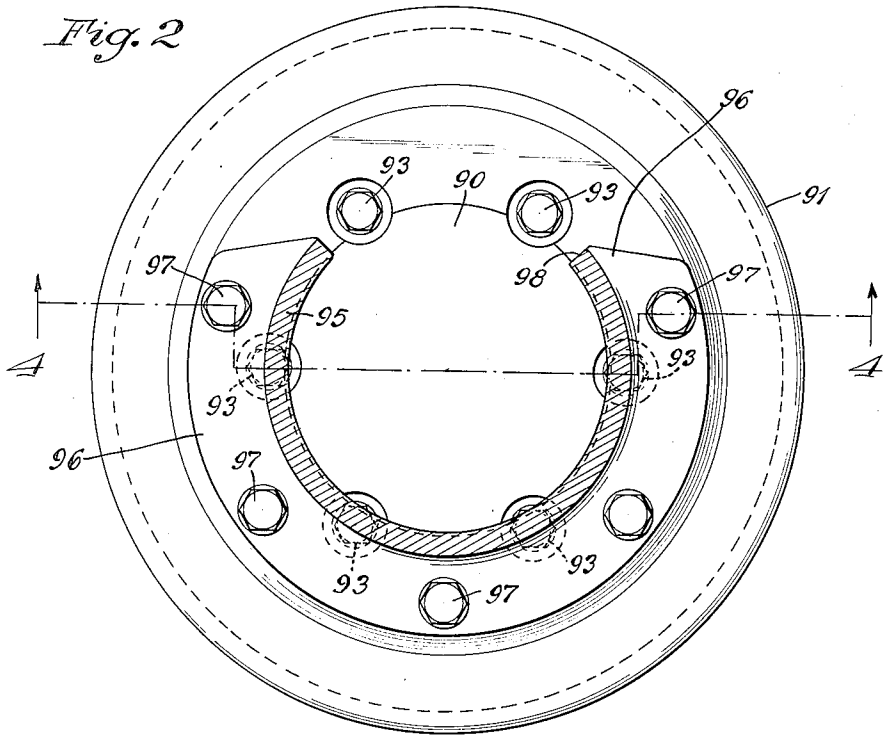
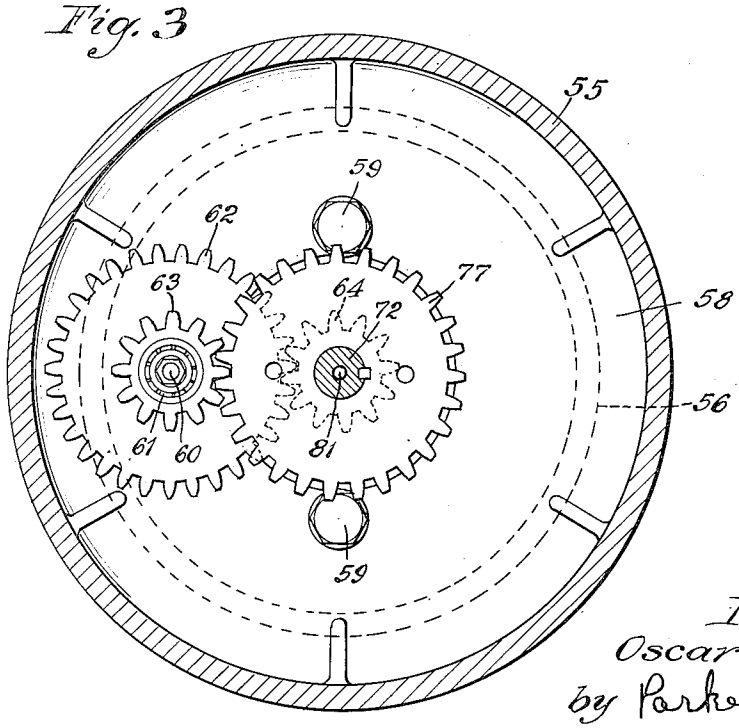


Fig. 3



Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys

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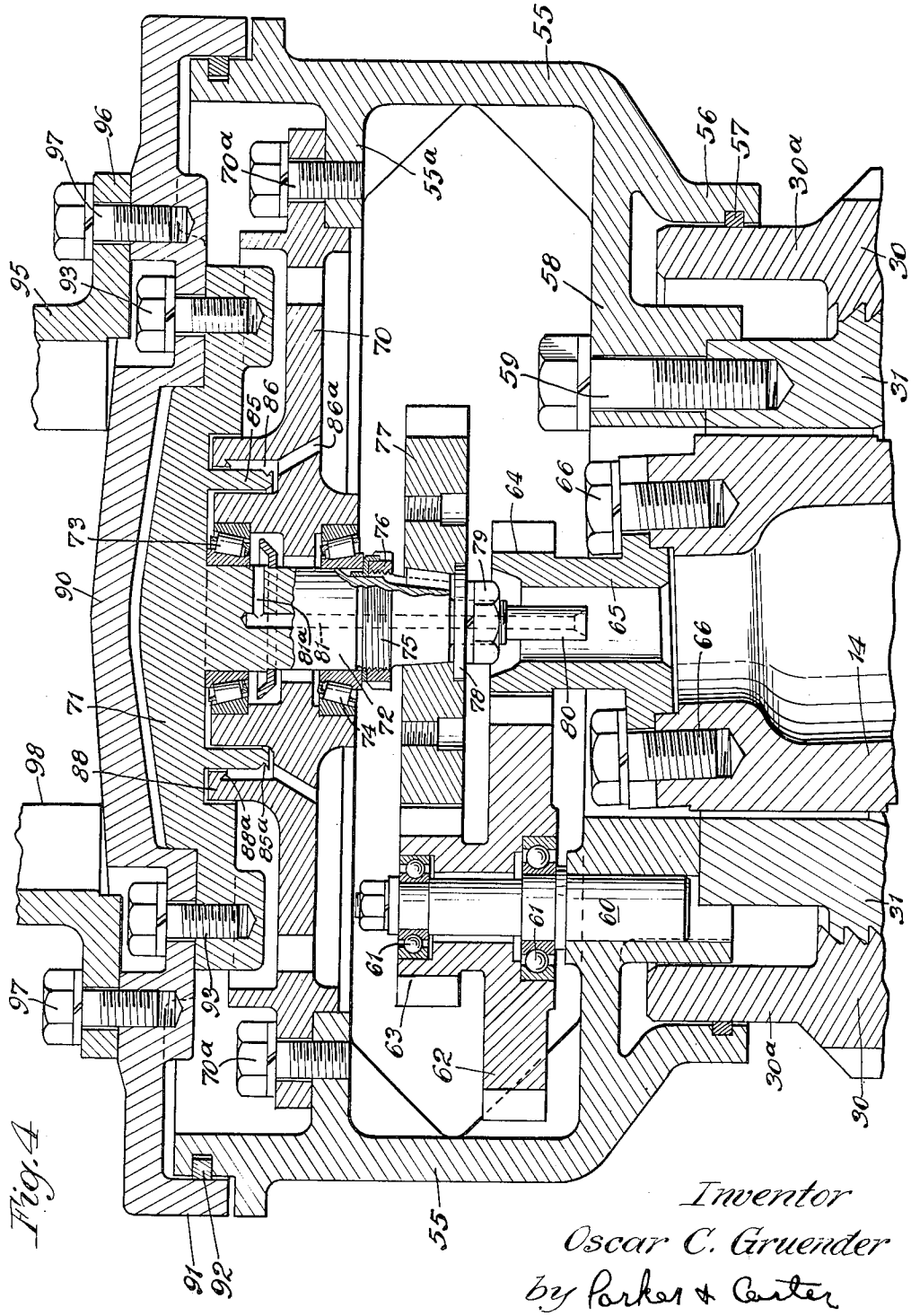


Fig. 4

Inventor
Oscar C. Gruender
by Parker & Carter
Attorneys.

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FEED PLATE FOR GYRATORY CRUSHERS

Oscar C. Gruender, Milwaukee, Wis., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Application September 1, 1949, Serial No. 113,538

5 Claims. (Cl. 241—202)

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My invention relates to an improvement in crushers or mills and has for one purpose to provide a feeding device for feeding material to be crushed or milled.

Another purpose is to provide an improved feeding assembly, usable with a gyrated crushing or milling element.

Another purpose is to provide an improved drive for a feed distributing member, usable with crushers and mills.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a partial vertical axial section;

Figure 2 is a section on an enlarged scale on the line 2—2 of Figure 1;

Figure 3 is a section on an enlarged scale on the line 3—3 of Figure 1; and

Figure 4 is a section on an enlarged scale on the line 4—4 of Figure 2.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 generally indicates an outer portion of the frame of a crusher or mill. The frame may include inwardly extending spider arms 2 and a central bottom hub 3. Extending upwardly from the arms 2 is a head supporting frame portion 4, upon which is positioned a spherical surfaced bearing ring 5.

The circumferential frame portion 6 defines a dust catching channel 7, the purposes of which will appear later, and which may be adapted to receive any suitable liquid, such as water, which may flow over the weir 8 and escape through any suitable outlet duct or ducts 9.

Secured in the hub 3 is a shaft 10 having an upward and generally cylindrical extension 11, terminating as at 12. It will be understood that the shaft 10, 11 is normally fixed in relation to the frame and is firmly held within the frame hub 3. Rotatable about the exterior of the upper portion 11 of the shaft 10 is the eccentrically apertured sleeve 13 shown as having a hollow upward extension 14, the purposes of which will appear later.

15 is any suitable bearing sleeve between the shaft portion 11 and the eccentric sleeve 13. Secured to the bottom of the eccentric sleeve 13 is the bevel gear 16, whereby the eccentric sleeve 13 is rotated by the shaft 17 through the bevel pinion 18. The shaft 17 is rotatable in any suitable sleeve 19, which may form part of or may be mounted on the frame. Surrounding the exterior surface of the eccentric sleeve 13 is a head sleeve 20 which forms the lower part of a head structure, which includes the obtuse conic head portion 21. 22 is any suitable bearing sleeve within the head sleeve 20, which is opposed to the exterior surface of the eccentric sleeve 13.

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It will be understood that X indicates the axis about which the eccentric sleeve 13 rotates and Y indicates the axis of the exterior surface of the eccentric sleeve 13, which is in contact with the inner surface of the head bearing sleeve 22. The axes intersect as at Z in Figure 1. It will be understood that the result of the rotation of the shaft 17 is to rotate the eccentric structure 13, 14 about the shaft, and about the axis X. The resultant movement of the head structure is a gyration of the head about the point Z. The head is shown as including or carrying an apron 25 which extends at all times into the liquid within the channel 7, thus providing an adequate dust seal. However, any other suitable dust seal may be employed. 26 is an outer dust apron on the head. 27 is the crushing or milling element proper, shown as an obtusely conic ring mounted upon the conic surface 28 of the head portion 21. It may be held in position for example by a thrust ring or truncated cone 29 which, in turn, is downwardly urged by the inwardly threaded locking ring 30 which is threaded upon the outwardly threaded sleeve portion 31 extending upwardly from the conic head portion 21. The locking ring 30 is provided with an upwardly extending smooth-surfaced cylindrical ring 30a, the purpose of which will later appear.

35 is a bowl supporting and centering ring which may form part of or be removably secured to an upper portion of the frame 1. Seated upon it is the tiltable bowl supporting ring 36, provided with a channel 37 which conforms to the upper projection of the fixed ring 35. The tilting bowl supporting ring 36 is inwardly threaded as at 38 to receive the outwardly threaded portion of the bowl structure generally indicated at 39. The bowl structure 39 is provided with an outwardly extending top flange 40, through which extend suitable locking screws 41 adapted to thrust against an upper portion of the ring 36, as shown in Figure 1. 42 is a housing ring which overlaps the upper portion of the bowl supporting ring 36 and which engages the sealing ring 43. A bowl sealing ring or packing 44 is interposed between the ring 36 and the bowl 39, whereby access of dust is prevented. The bowl 39 has an inwardly and downwardly conic bottom portion 45 against which the upper crushing or milling member or liner 46 is held by any suitable means. The members 27 and 46 define between them the crushing or milling space to which particles are fed. 47 is any suitable removable feed hopper which masks the liner securing means generally indicated at 48. 49 is an upper feed housing which may rest upon an upper portion of the bowl structure 39. A feed spout 50 may extend downwardly therethrough from any suitable feeding assembly 51.

Secured to the upper head portion 31 is a feed and drive housing generally indicated as 55. It

has a downwardly extending edge portion 56 which surrounds the upper flange 30*a* of the locking ring 30 and is provided with any suitable sealing ring or packing 57. The housing 55 has an inwardly extending portion 58 through which pass any suitable locking screws 59, whereby the housing 55 is secured to the upper head portion or sleeve 31. Thus the housing 55 moves in unison with the head without in the least interfering with the automatic tightening feature of the locking ring 30 and the thrust ring or cone 29. Upwardly extending from the member 58 is the normally fixed shaft or stub 60, provided with bearings 61 about which rotate unitarily the gear 62 and the pinion 63. The gear 62 is in mesh with the pinion 64 on the hollow stub 65 which is secured, for example by screws 66, to the upper end of the eccentric 14. Thus the gear 62 is rotated by the rotation of the eccentric sleeve 13, 14.

70 is a bearing supporting plate secured at its edges by screws 70*a* to the flange 55*a*, inwardly projecting from the circumferential wall of the housing 55. Positioned above it and rotatably supported thereon is the spinner plate 71 from which depends the shaft 72, rotating in bearings 73, 74. The shaft 72 is threaded as at 75 to receive the bearing engaging ring 76. Secured to the tapered lower end of the shaft 72 is the gear 77 in mesh with the pinion 63. It may be secured by any suitable washer 78 and lock nut 79. The shaft 72 is shown as having a downward tubular extension 80 which extends into the hollow of the stub 65. 81 is an oiling duct having its lower end extending axially through the shaft 72, and having at its upper end a radial passage 81*a*.

The spinner plate 71 is shown as having a downwardly extending annular flange 85, extending into an appropriate channel 86 in the upper surface of the plate 70. The channel is bounded by the annular flange 88. The flanges 85 and 88 are notched as at 85*a* and 88*a*. Secured to the upper surface of the spinner plate 71 and rotating therewith is the cover plate generally indicated as 90. It is provided with a downwardly extending outer flange 91 surrounding and engaging the packing ring 92 on a portion of the housing 55. The plate 90 is removably secured to the plate 71, for example by locking screws 93. Secured to the upper surface of the plate 90 is the open top cylinder 95. The cylinder is shown as having a bottom outwardly extending flange 96 through which pass any suitable securing screws 97. The cylinder 95 is provided with a discharge aperture or door 98, the flange 96 being interrupted opposite the door, whereby material delivered through the down spout 50 may be freely centrifugally expelled outwardly across the upper surface of the plate 90.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless many changes may be made in size, shape, number and disposition of parts without departing from the spirit and scope of my invention. I have illustrated the new improved feeding means as applied to a structure generally similar to the structure shown in my co-pending applications Serial Nos. 766,043 and 766,044 filed in the United States Patent Office August 4, 1947. However, my invention is applicable to a wide variety of crushers and mills and other structures in which it may be desired to deliver a homogeneously mixed feed to a circumferentially extending treating chamber or zone.

The use and operation of my invention are as follows:

I illustrate my invention as applied to a gyratory crusher or mill in which a head 21 is gyrated within a bowl 45. The opposed milling or crushing members 27, 46 are mounted respectively on the head 21 and on the normally fixed but tiltable bowl 39. The bowl supporting ring 38 is normally held fixed in relation to the frame 1. Any suitable yielding release may be employed, or the yielding release feature may be omitted. I illustrate, for example, a pneumatic system including cylinders 110 and pistons 115. This pneumatic system is disclosed in my above-mentioned co-pending applications Serial Nos. 766,043 and 766,044. However, springs or any other suitable yielding means may be employed.

In my mill and method of the said earlier applications, I find it important to deliver a homogeneous feed. I therefore have provided the structure of the present application as means for maintaining a uniform and homogeneous feed, which can be properly timed and properly controlled. I employ the rotated eccentric 13, 14 which impart the gyratory movement to the head, as a means for rotating the top feed plate 90 with its upper cylinder or housing 95 and its feed delivering gate 98. Material is delivered at any desired rate downwardly through the spout 50. All of the material so delivered enters through the open top of the cylinder 95 an drops downwardly upon the plate 90 or upon particles already positioned above the plate 90. The relatively rapid rotation of the plate 90 and the cylinder 95, in response to rotation of the eccentrics 13, 14, together with its gyratory movement, delivers a thoroughly mixed feed in which various sizes of particles are homogeneously mixed throughout the mass. In other words, in handling a feed in which particles of a substantial size range are included, my structure prevents segregation and any concentration by size or any substantial inequalities in distribution of particles by size throughout the mass. The feed is delivered uniformly around the entire periphery of the upper opening of the crushing cavity. In the use of my crusher, I find it practical to permit material to build up above the actual crushing zone defined by the opposed surfaces of the members 27 and 46. There is no disadvantage in building up a head of material above the crushing zone, but it is very important that, in the head of material thus built up, the large and intermediate size particles are uniformly and homogeneously distributed throughout the mass. The desired result is obtained by my above-described structure.

The parts are readily accessible by release of the screws 97, 93 and 70*a*.

The above-described feed plate mechanism is automatically lubricated by the oil from the inner eccentric bushing 15. Some of the oil flows upwardly through the duct 81 and, through the side passage 81*a*, lubricates the bearings 73, 74. Also some of the oil flows upwardly between the tubular extension 80 of the shaft 72 and the hollow shaft 65 providing lubrication for the train of gears in the housing 55. Oil escapes also to the channel 86 and may pass downwardly to 86*a* to the enclosed portion of the housing 55. Thus any oil which overflows the upper bearing 73 will be carried back to the inside of the feed plate or gear box 55.

The rate of rotation can be controlled to suit the needs of a particular job. As an example, I have employed a mill with an eccentric speed

of about 310 R. P. M., with a gear reduction providing a speed of about 55 R. P. M. of the feed plate 99. It will be understood that the head is free to rotate around its axis in either direction without interfering with the rotation of the feed plate. The hopper is rotated sufficiently to provide a thorough mixture of the material, the rectangular opening 98 permitting centrifugal feed in a uniform stream, which moves at a uniform rate around the top of the attrition chamber defined by the members 27 and 46. The material is thoroughly mixed by the combined gyrating and rotating action before it escapes through the gate or window 98. Thus each portion of the attrition chamber will receive a uniform percentage of the fines in the feed, even if a high degree of segregation exists in the material as delivered through the down spout 50.

I claim:

1. In a crusher or attrition mill, having opposed crushing members surrounding a generally vertical axis, an upper and normally fixed material engaging member, a lower material engaging member, the two members defining together a crushing or attrition zone, gyrating means for imparting to the lower material engaging member a gyratory movement toward and away from the upper material engaging member, about a center positioned adjacent the top of the crushing or attrition zone, a circumferential hopper wall formed and adapted to deliver material directly into the annular upper portion of the said crushing or attrition zone throughout its circumference, centrifugal means in said hopper for mixing material and for distributing the material, to the crushing or attrition zone, including a feed receiving member mounted for rotation about an axis substantially parallel and adjacent the vertical axis of the mill, means for delivering feed to said feed receiving member, and driving means for rotating the feed receiving member at a sufficient rate of rotation to impart substantial centrifugal movement to articles fed thereto, but insufficient to cause segregation, whereby said feed receiving member is adapted to distribute material throughout the circumference of the hopper, said driving means including a differential driving connection with said gyrating means, said differential driving connection being formed and adapted to rotate the feed receiving member at a rate substantially lower than the rate at which the gyrating means gyrates the lower material engaging member, said feed receiving member being mounted for gyration in unison with the lower material engaging member.

2. The structure of claim 1 characterized in that the feed receiving member has a discharge aperture positioned and adapted to direct a localized generally radial stream of material whereby, in response to the rotation of the feed receiving member, the outwardly delivered stream of material is rapidly rotated about the entire circumference of the hopper, and of the crushing or attrition zone.

3. The structure of claim 1 characterized in that the differential driving connection between the gyrating means and the feed receiving member includes a gear box, a train of gears in the gear box, and sealing connections between the gear box and the lower material engaging member and between the gear box and the feed receiving member.

4. In a gyratory mill or crusher having opposed crushing members surrounding a generally vertical axis, a head and a bowl defining together a crushing cavity, a main frame on which said head and bowl are mounted, and means for gyrating the head including an eccentrically apertured sleeve and means for rotating it, a feed plate positioned above said head and means for rotating it at sufficient speed in relation to the diameter of the head for centrifugal discharge of particles upon the top of the plate, including means for rotating said plate at a speed of rotation substantially slower than that of the speed of rotation of the eccentrically apertured sleeve, said means constituting a differential driving connection including a gear box mounted on said head, for gyration in unison therewith, a train of gears in said gear box including a gear mounted for rotation about an axis fixed in relation to said gear box, a gear directly driven by the eccentrically apertured sleeve, and a gear mounted for movement in unison with the feed plate, the feed plate being rotatable in relation to the gear box and gyrating with the gear box and overlying the train of gears.

5. In a crusher or attrition mill, an upper and normally fixed material engaging member, surrounding a generally vertical axis, a lower material engaging member, the two members defining together a crushing or attrition zone, gyrating means for imparting to the lower material engaging member a gyratory movement toward and away from the upper material engaging member, about a center positioned adjacent the top of the crushing or attrition zone, a circumferential hopper wall formed and adapted to deliver material directly downwardly into the annular upper portion of the said crushing or attrition zone throughout its circumference, means in said hopper for mixing material and for distributing the material, to the crushing or attrition zone, including a rotary feed receiving member mounted for rotation about an axis adjacent and generally parallel to the vertical axis of the mill, means for delivering feed to said feed receiving member and for maintaining a column of feed on the member, and driving means for rotating the feed receiving member at a sufficient rate of rotation to impart substantial centrifugal movement to articles fed thereto, but insufficient to cause segregation, whereby said feed receiving member is adapted to distribute material throughout the circumference of the hopper, said driving means including a differential driving connection formed and adapted to gyrate the feed receiving member and to rotate it at a rate of rotation substantially less than the rate of gyration of the lower material engaging member.

OSCAR C. GRUENDER.

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