Oct. 10, 1944. O. C. GRUENDER 2,359,987

PEDESTAL TYPE CRUSHER

Filed Feb. 14, 1941 3 Sheets-Sheet 1

Fig. 1

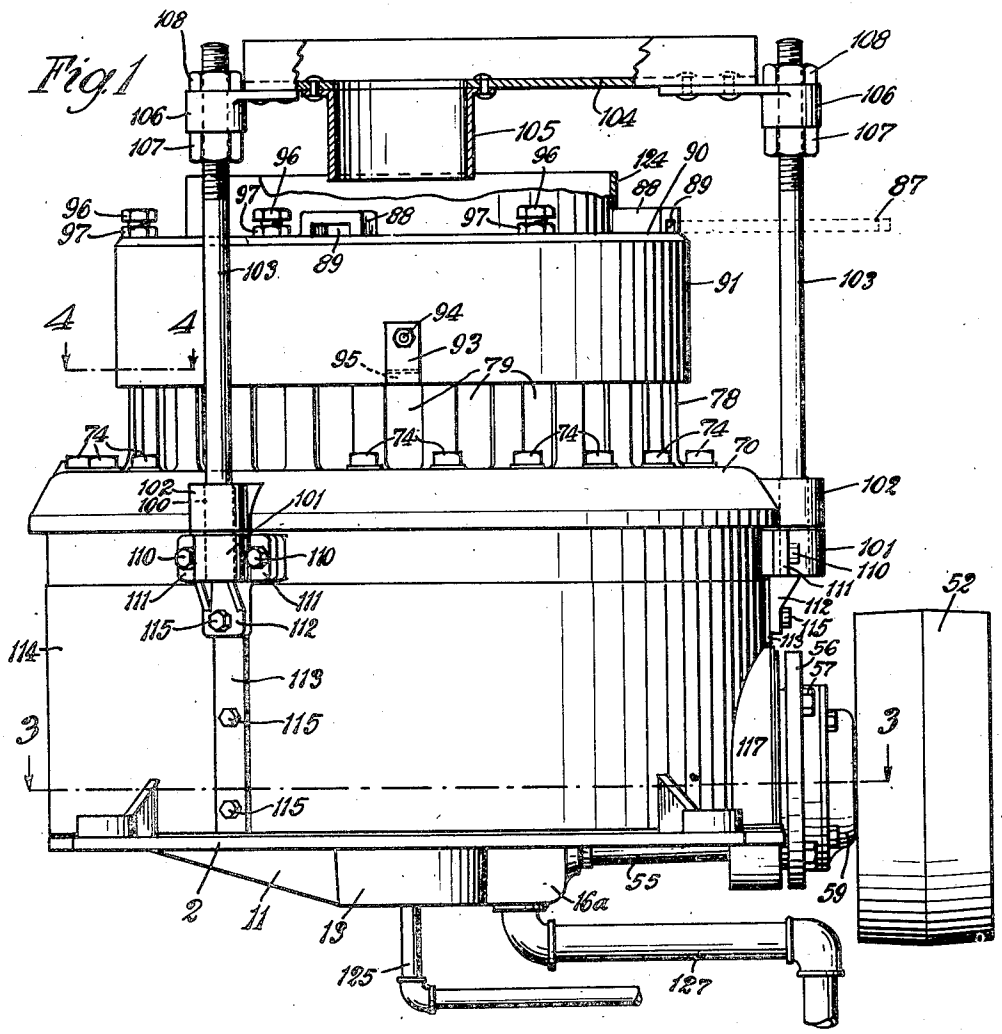


Fig. 6

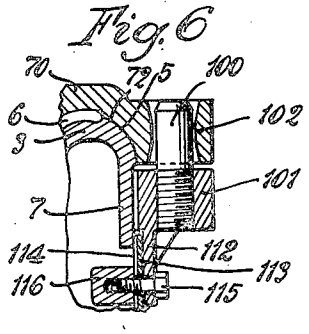
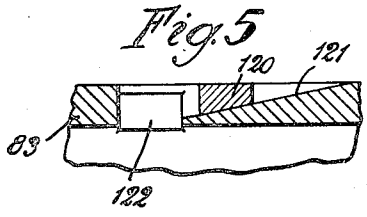


Fig. 5



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PEDESTAL TYPE CRUSHER

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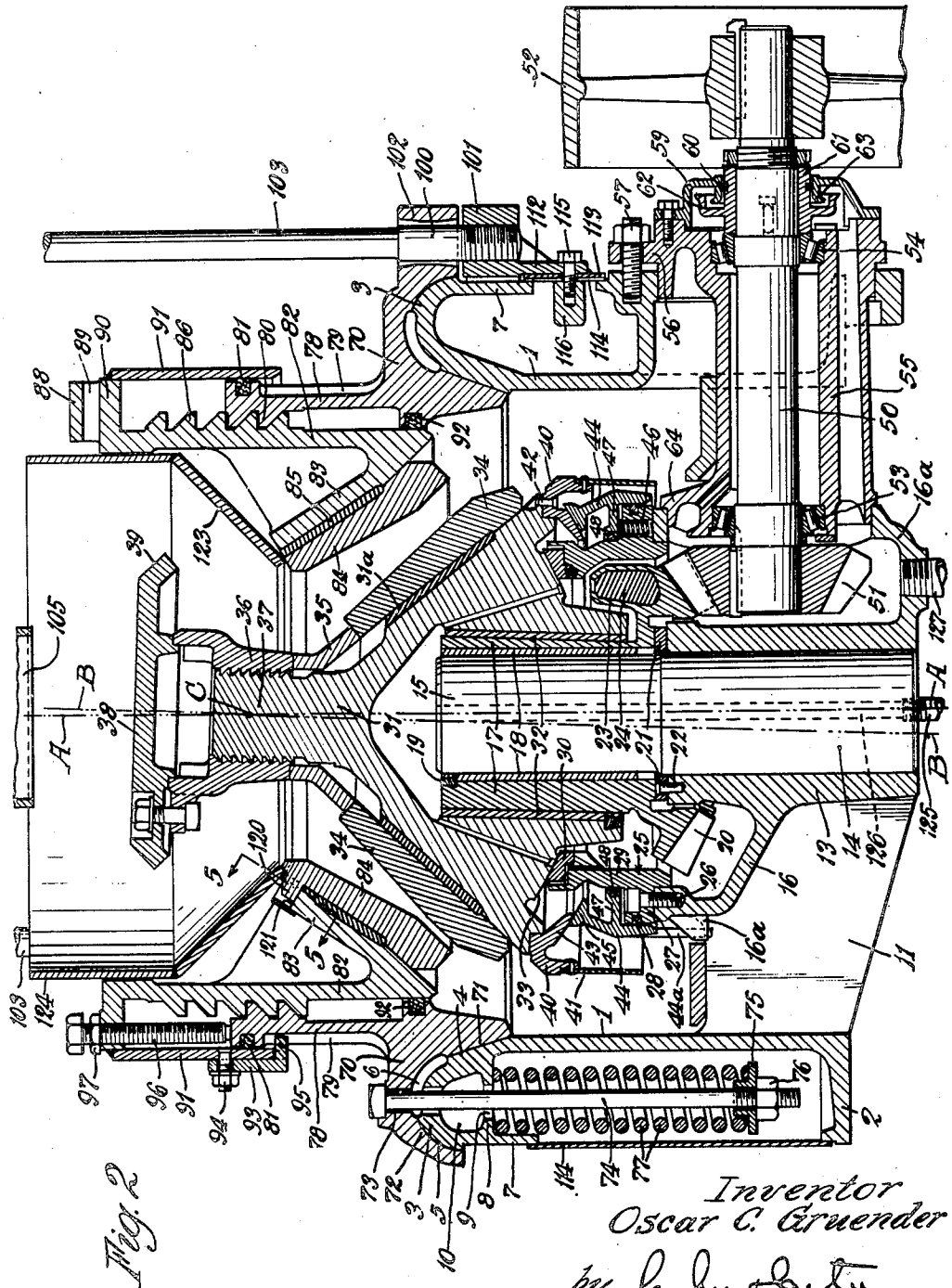

Fig. 2

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PEDESTAL TYPE CRUSHER

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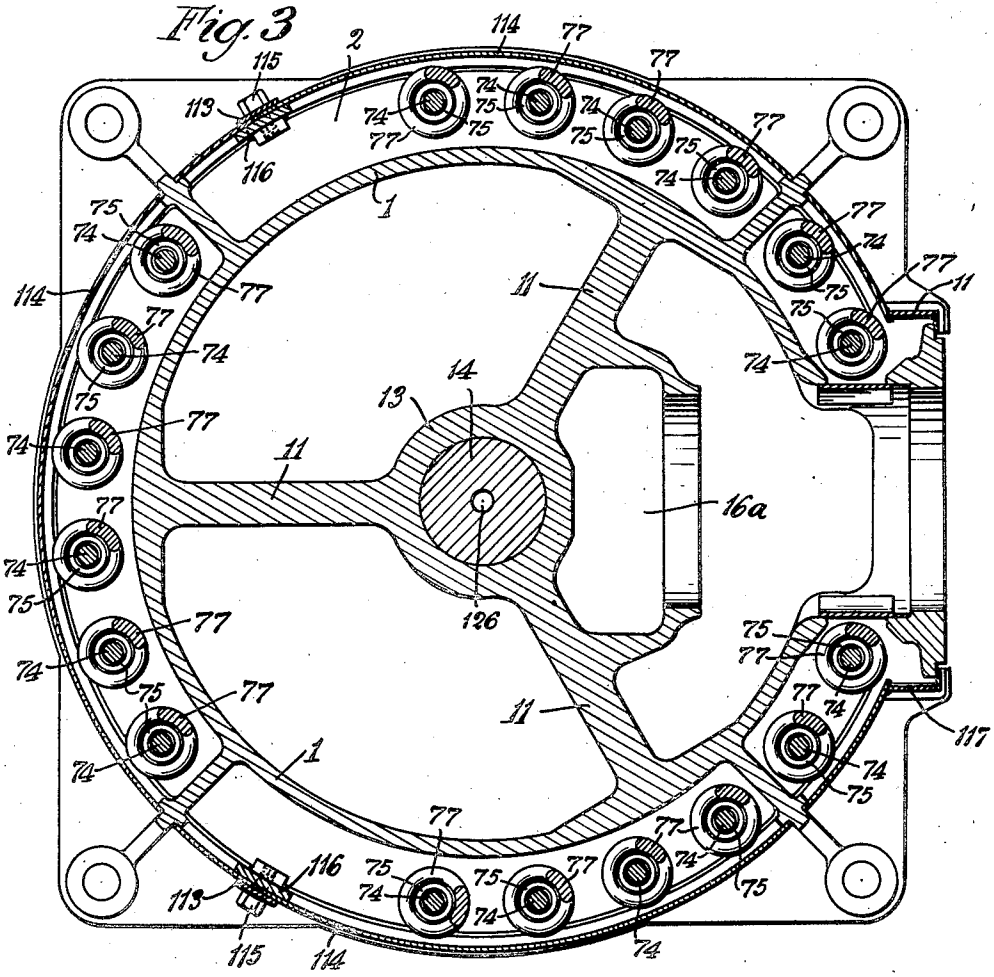
Fig. 3



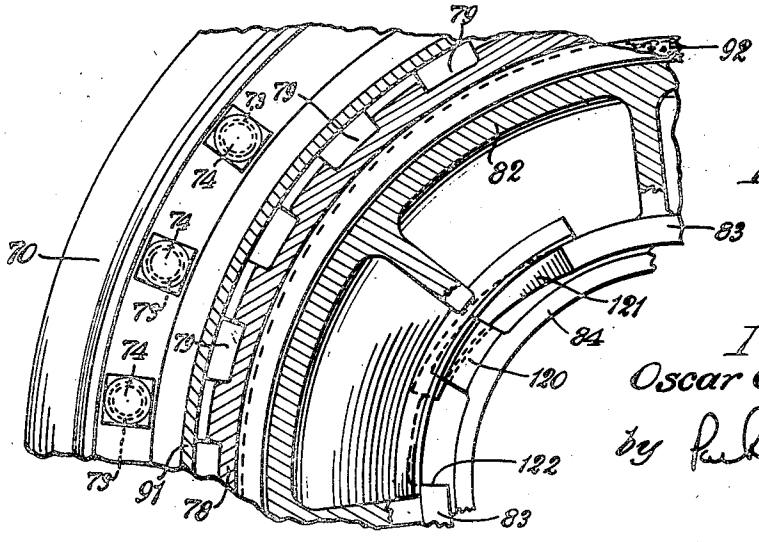


Fig. 4

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UNITED STATES PATENT OFFICE

2,359,987

PEDESTAL TYPE CRUSHER

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Application February 14, 1941, Serial No. 378,850

12 Claims. (Cl. 83—10)

My invention relates to an improvement in gyratory crushers and has for one purpose the provision of a gyratory crusher which shall combine a minimum vertical height, light weight, and sturdy construction.

Another purpose is the provision of improved means for supporting a gyrated crushing head, said means reacting not only to the entire vertical crushing force, but also to a portion of the horizontal or lateral crushing force.

Another purpose is the provision of a normally fixed generally central supporting post about which the crushing head may gyrate.

Another purpose is the provision of improved oil sealing means and dust guard means for the head.

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:

Fig. 1 is a side elevation with parts in vertical section;

Fig. 2 is a vertical axial section on a slightly larger scale;

Fig. 3 is a section on an enlarged scale along the line 3—3 of Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig. 1, on an enlarged scale;

Fig. 5 is a section on the line 5—5 of Fig. 2; and

Fig. 6 is a partial section of a variant form.

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

Referring to the drawings, 1 generally indicates any suitable circumferentially extending outer frame having a bottom outwardly extending flange 2 and an upper outwardly extending flange 3, having a conic inner surface portion 4, and a rounded upper and outer surface 5, the two being separated by a reduced or cutaway portion 6. The rounded portion 5 extends downwardly in the form of a circumferential apron 7. The flange also includes a generally horizontal portion 8, having apertures 9, the purpose of which will later appear. If desired, the interior of the flange may be more or less cored out or enlarged, as at 10.

Numerals 11 indicate inwardly extending radial spider portions which support an inner sleeve 13, in which may be mounted the lower portion of a post 14. It may be secured in any suitable manner, by press fit, or otherwise. It includes an upwardly extending portion 15, herein shown as of slightly less diameter. Extending upwardly and outwardly from the sleeve 13 is the housing portion 16.

17 indicates an eccentrically apertured sleeve which surrounds the upper post portion 15. 18 is any suitable anti-frictional bushing of bronze or the like, which may be keyed or secured to the sleeve as by any suitable member 19. The sleeve 17 has secured to or formed integrally with the bottom thereof, a gear 20.

It will be observed, as in Fig. 2, that the inner face of the gear 20 overlaps and is spaced outwardly slightly away from the upper portion of the sleeve 13, the gear being provided with a definite internal bore, the clearance between it and the opposed portion of the sleeve 13 being slight but sufficient normally to prevent bearing contact.

In the event of shaft failure, for example breakage of the shaft 15, the gear 20 will immediately contact the outer surface of the sleeve 13 and prevent misalignment and consequent distortion of the gear teeth. Whenever the shaft fails, the eccentric 17 will continue to rotate, and unless means such as those above described were provided to permit rotation of the gear around the axis of the sleeve 13, failure of the gear teeth might ensue.

The sleeve 17 may be supported for example upon any suitable bearing ring 21, mounted on and preferably secured to the upper end of the sleeve 13. It may be held against rotation as by any suitable pins 22. The member 20 is shown as depending about the outside of the upper end of the sleeve 13 and is housed within the housing 16. It may be counterweighted, as by the pocket portion 23, which may be filled with lead, as at 24. Mounted upon the upper edge of the housing portion 16 is a housing ring generally indicated as 25. It may be secured to the upper edge of the housing portion 16, as by any suitable bolts 26. It includes an outer wall portion 27, channeled to receive a piston ring or the like 28. It includes also an inner wall portion 29, upon the top of which is mounted a spherical surfaced supporting ring 30.

31 generally indicates a head structure having an inner bearing sleeve 32 adapted to engage the exterior of the eccentric 17. The head also is provided with a downwardly convex spherical bearing surface 33 adapted to rest upon and conform to the upwardly concave spherical bearing surface of the supporting ring 30. 34 is any suitable generally conic mantle, which may be held in position upon the outer conic face of the head 31, as by any suitable thrust transmit-

ting member 35 and screw threaded nut 36, which is screw threaded to the upper extension 37 of the head 31. Any suitable packing, for example zinc 31*a*, may be interposed between the conic mantle 34 and the head 31.

38 is any suitable feed limiting or distributing plate, having a generally flat upper surface and a generally conic edge portion 39. Secured to the lower outer edge of the head 31 is a ring 40, which carries at its outer edge a depending apron 41. The ring 40 may be riveted as by rivets 42, which permit its removal from the head 31. The ring 40 also has an inwardly extending portion 43, the lower surface of which has a downwardly convex spherical bearing surface opposed to a correspondingly surfaced portion 45 of a wiping ring 44. The wiping ring structure 44 is normally upwardly urged as by springs 46.

The lower portion of the member 44 has an inward generally cylindrical surface opposed to a piston or wiping ring 28. It also has an inward extension 47 which carries at its inner end a wiping ring 48 opposed to the generally cylindrical exterior of the member 29. The space between the members 44 and 29 constitutes a dirt receiving pocket. The member 44 is locked against rotation by any suitable locking means, for example by downwardly projecting fingers 44*a* which engage a lug 16*a* on the housing portion 16.

In order to rotate the eccentric 17 and thus gyrate the head 31, I employ a shaft 50, having a beveled pinion 51, in mesh with the gear 20, and a pulley 52, from which a belt or other driving means may extend to any suitable power source not herein shown. The shaft 50 is mounted in the bearings 53, 54, located within a surrounding sleeve 55, which is removable as a unit with the bearings and shaft. The sleeve has an outer enlargement 56, which may be bolted as by the bolts 57 to the exterior of the frame 1, which is appropriately apertured to permit this penetration.

59 indicates any suitable removable oil seal housing, the inner face of which is opposed to any suitable piston or sealing ring 60, mounted on the sleeve 61, which is keyed to the shaft. The sleeve 61 has an outwardly extending labyrinth portion 62, which cooperates with the inward extension 63 of the housing 59, to provide a labyrinth as an additional oil retaining means. The inner end of the sleeve 55 has an enlarged portion 64, which seals against the edges of any suitable aperture formed in the housing portion 16, and the downward extension 16*a* of such housing portion.

70 indicates a bowl support having a conic portion 71 conforming to the conic surface 4 of the main frame, and a portion 72 conforming to the surface 3 of the top of the main frame or its outward extending flange. The ring 70 is provided with apertures 73, to permit the penetration therethrough of any suitable bolts or tension members 74, which are provided with spring abutments 75, which may be adjusted as by nuts 76. The springs 77 are compressed between such abutments 75 and the horizontal portion 8.

As will appear from Fig. 3, I illustrate three sets of the bolts 74 and springs 77, in each of which six springs and bolts are shown. These are so spaced as to maintain an equalized downward thrust throughout about the circumference of the crusher.

The ring 70 has an upward generally cylindrical extension 78, having a plurality of vertical grooves 79 formed therein. It is inwardly screw threaded adjacent the top, as at 80. 81 indicates any suitable packing seated in the outer face of the upper portion thereof.

82 is an outer generally cylindrical member having an inner conic member 83, adapted to receive any suitable bowl liner 84. 85 is any suitable zinc or packing therebetween. The member 82 is outwardly threaded, as at 86, these threads being in mesh with the threads 80 of the portion 78. It will thus appear that the member 82, when rotated, as by means of any suitable lever 87, shown in dotted line in Fig. 1, is raised or lowered, depending upon the direction of rotation. The lever or levers 87 may be received in any suitable pocket member or members 88, having a lever receiving aperture 89. Downwardly extending from the top ring 90 of the member 82 is a cylindrical shield 91, which may be welded or otherwise secured thereto, and which extends downwardly about and in wiping contact with the sealing ring 81, thus protecting the upper side of the screw threads from dust or grit. The lower side is protected, for example, by any suitable sealing ring 92, received in an inner portion of the member 70 and opposed to the outer wall of a lower portion of the member 82.

The member 82 may be locked against rotation for example by any suitable clamp or clamps 93, of which only one is illustrated. It may be secured to the cylindrical shield 91 as by any suitable bolt 94, and includes an inwardly extending portion 95 adapted to penetrate one of the vertical grooves or slots 79. The members 78 and 82 may further be locked together, and play may be prevented, as by the employment of bolts or thrust screws 96, with their appropriate locknuts 97, shown in Fig. 2. The lower ends of these thrust screws abut against the top of the member 78.

The rotation of the ring 70 in relation to the main frame may be prevented by the employment of pins 100, mounted in lugs 101 on the main frame and penetrating apertured lugs 102 ouwardly extending from the ring 70, as shown in Fig. 6; or, if desired, supporting pins or shafts 103 may be employed, as shown in Figs. 1 and 2, which constitute merely upper extensions of the pins 100 of Fig. 6. These may be employed to perform the double function of preventing rotation of the ring 70 and of supporting any suitable feed platform or feed structure 104, with its inner spout 105. The feed platform 104 may be adjusted vertically along the pins 103 by any suitable sleeves 106 and nuts 107, 108, as shown in Fig. 1.

The lugs 101 may be cast integral with the apron 7 of the main frame 1 or, as illustrated in Figs. 1 and 2, may be secured to the apron 7 by means of bolts 110 which pass through flanges 111 on either side of the lugs 101. The lugs are further provided with a downwardly projecting flange 112 to which is welded a bar 113.

The springs 77 may be housed as by the employment of a circumferential cover 114, which may be formed in a plurality of sections. I illustrate, for example, the use of three sections, the sections being secured together by means of the bars 113 above described, which overlie the joints as illustrated in Fig. 3. Bolts 115 passing through the bars 113 and the flange 112 of the lugs 101 are screw threaded into vertical bars 116, or other suitable abutments integral with or secured, for example, by welding to the apron 7 and flange 2 of the outer frame 1. Two of

the housing sections are provided with flanges 117 suitably formed to straddle the bearing sleeve 55.

The bowl 84 may be mounted in any suitable manner, but I illustrate a wedging connection between it and the conic bowl support 83. I illustrate, for example, a plurality of outwardly extending lugs 120, which rest upon the tapered ledges or faces 121 at the top of the member 83. The member 83 is cut away as at 122 to permit the lugs 120 to be pushed in place before the bowl liner 84 is rotated in order to lock it.

Positioned above the bowl liner is a conical feed spout 123 provided with a cylindrical upper portion 124, which is in alignment with the spout 105 of the feed structure 104. 125 generally indicates an oil feed line in communication with an oil duct 126 in the shaft 14, 15, and 127 is an oil return line which may be connected to any suitable oil reservoir and pump not illustrated in the drawings.

It will be realized that, whereas I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing. For example, where in the specification and claims the term "generally cylindrical" is employed, it will be understood that it is intended to be of sufficient breadth to cover tapered or stepped bearings. The use and operation of my invention are as follows:

I find it advantageous to provide a gyratory crusher of relatively small vertical height. I therefore provide a fixed shaft 14, 15, the upper portion 15 of which penetrates within the head 31, and serves as a bearing for the upward extension of the eccentric 17 within the head. However, it is not desirable to support the head upon the eccentric 17, and I therefore provide a surrounding socket bearing including the upwardly concaved spherical surfaced supporting member 30, which is opposed to a correspondingly formed lower spherical portion 33 of the head. This particular construction permits the member 30 to take a portion of the horizontal or lateral crushing force, besides sustaining the entire vertical crushing force.

Rotation of the shaft 50 and the gears 51 and 20 results in rotation of the eccentric 17. The eccentric has a bore concentric with the axis A—A of the shaft 15, but its outer cylindrical bearing surface is inclined at an angle with respect to its bore, and is concentric with the axis B—B. These two axes intersect at point C, as illustrated in Fig. 2, and it is around this point that the head gyrates, resulting in a larger movement at the bottom of the head than at its top.

In order to prevent breakage due to the passage of tramp iron or uncrushable material through the machine, I provide tension members, or rods 74, with their accompanying compression springs 77.

I have to provide space for the drive shaft 50 and its associated parts, and I therefore find it desirable, in order to maintain equal moment, to divide the springs into separate groups spaced apart as shown in Fig. 3. I illustrate three groups of six springs each, but of course the number may be varied. I also find it desirable to provide a recess in the frame defined at the bottom by the flange 2 and at the top by the flange 3, which recess may be closed by plates 114, the springs thus being concealed and protected against water and other corrosive elements, with the consequent improvement in the appearance of the machine.

In order to protect the threads 80, 86 from dust, I provide in effect a telescopic housing, the inner portion of which is provided by the member 82 and the outer portion by the welded ring 91, the inner and outer portion moving as a unit. 92 is a dust seal between the inner portion and the bowl supporting ring 70, and 81 is a dust seal between the outer portion 91 and the outer face of the upward extension 78 from the ring 70. The result is a simple, efficient dust seal for both the top and the bottom of the adjusting threads.

In order to lock the bowl when it is set I may employ the set screws 96, which take up play between the opposed threads and the positive locking member 93, 95, the inner portion 95 of which seats in one of the vertical grooves 79. I may employ any desired number of the members 93, 95, but three are ample. The enclosed spacing of the vertical slots or grooves 79 permits the device to be locked at any desired setting. I may prevent rotation of the bowl ring 70 on the frame either by the pins 100, screw threaded into sockets 101, or by the feed spout supports 103.

I claim:

1. In a gyratory crusher, a main frame, a generally cylindrical generally vertical pedestal upstanding therefrom and normally fixed in relation thereto, an eccentrically apertured sleeve rotatably mounted on said pedestal, and means for supporting it, said sleeve having inner and outer bearing faces, the axis of the outer face being inclined in relation to the axis of the inner, means for rotating said sleeve, an upwardly concave generally spherical bearing on said frame and located exteriorly of said pedestal and eccentric, a head surrounding said sleeve and pedestal and including a portion extending above but out of contact with the top of said pedestal, and a bearing portion conforming to the exterior bearing surface of said eccentrically apertured sleeve and parallel with the axis of the head, said head having also a generally spherical downwardly convex bearing portion resting upon the upwardly concave spherical bearing on the frame, substantially the entire weight of the head being supported upon said spherical bearing of the frame, and an oil seal exterior to said bearing portion and including a sealing ring unitary with said head and having a downwardly convex spherical bearing surface concentric with said first mentioned spherical bearing surfaces, and a vertical movable sealing ring mounted on the frame and opposed thereto, and yielding means for urging it upwardly against said sealing portion of the head.

2. In a gyratory crusher, a main frame, a pedestal upstanding therefrom and normally fixed in relation thereto, said pedestal having an exterior vertically axised bearing surface, an eccentrically apertured sleeve mounted for rotation about said pedestal, means for supporting it, and means for rotating it, said sleeve having an inner bearing surface conforming to the bearing surface of the pedestal, and an outer bearing surface the axis of which is inclined to the axis of the bearing surface of the pedestal, a crushing

head surrounding said pedestal and eccentrically apertured sleeve, and having a bearing surface conforming to the exterior bearing surface of said sleeve, the axis of said bearing surface being concentric with the axis of the head, and a fixed head supporting bearing supported by said frame exterior of said pedestal and sleeve, adapted to receive substantially the entire weight of the head, and spaced radially outwardly substantially beyond said sleeve.

3. In a gyratory crusher, a main frame, a generally cylindrical generally vertical pedestal upstanding therefrom and normally fixed in relation thereto, an eccentrically apertured sleeve rotatably mounted on said pedestal, and means for supporting it, said sleeve having inner and outer bearing faces, the axis of the outer face being inclined in relation to the axis of the inner, said axes intersecting above the top of the sleeve, means for rotating said sleeve, an upwardly concave generally spherical bearing on said frame and located exteriorly of said pedestal and eccentric, a head surrounding said sleeve and pedestal and including a portion extending above but out of contact with the top of said pedestal, and a bearing portion conforming to the exterior bearing surface of said eccentrically apertured sleeve and parallel with the axis of the head, said head having also a generally spherical downwardly convex bearing portion resting upon the upwardly concave spherical bearing on the frame, and an oil seal exterior to said bearing portion and including a sealing ring unitary with said head and having a downwardly convex spherical bearing surface concentric with said first mentioned spherical bearing surfaces, and a vertical movable sealing ring mounted on the frame and opposed thereto, and yielding means for urging it upwardly against said sealing portion of the head, said concave spherical bearing being adapted to receive substantially the entire weight of the head, said concave spherical bearing and sealing means being spaced radially substantially outwardly from said sleeve.

4. In a gyratory crusher, a main frame, a pedestal upstanding therefrom and normally fixed in relation thereto, said pedestal having an exterior vertically axised bearing surface, an eccentrically apertured sleeve mounted for rotation about said pedestal, means for supporting it, and means for rotating it, said sleeve having an inner bearing surface conforming to the bearing surface of the pedestal, and an outer bearing surface the axis of which is inclined to the axis of the bearing surface of the pedestal, a crushing head surrounding said pedestal and eccentrically apertured sleeve, and having a bearing surface conforming to the exterior bearing surface of said sleeve, the axis of said bearing surface being concentric with the axis of the head, supporting means for said head located upon said frame exterior of said pedestal and sleeve adapted to receive substantially the entire vertical thrust of the head, and oil seal means exterior to said supporting means, said supporting means and oil seal means being spaced radially substantially outwardly from said sleeve.

5. In a gyratory crusher, a crusher frame, an upstanding element on said frame having a generally cylindrical generally vertical exterior side bearing surface, an eccentrically apertured sleeve surrounding and conforming to said exterior bearing surface, and means for rotating it, said sleeve having exterior and interior generally cylindrical bearing surfaces, the axes of which are inclined to each other, and intersect above the top of the sleeve, and a head having a bearing surface surrounding and conforming to the exterior bearing surface of the eccentric sleeve, supporting means for said head, including an upwardly concave spherical bearing element supported by the frame and located radially exteriorly of said eccentrically apertured sleeve, and a downwardly convex spherical bearing element conforming thereto and associated with the head, said upwardly concave spherical bearing element constituting the sole vertical support for the head.

6. In a gyratory crusher, a crusher frame, an upstanding element on said frame having a generally cylindrical generally vertical exterior side bearing surface, an eccentrically apertured sleeve surrounding and conforming to said exterior bearing surface, and means for rotating it, said sleeve having exterior and interior generally cylindrical bearing surfaces, the axes of which are inclined to each other, and a head having a bearing surface surrounding and conforming to the exterior bearing surface of the eccentric sleeve, supporting means for said head, including an upwardly concave spherical bearing element supported by the frame and located radially exteriorly of said eccentrically apertured sleeve and at a level intermediate the upper and the lower end thereof, and a downwardly convex spherical bearing element conforming thereto and associated with the head, said upwardly concave spherical bearing element constituting the sole vertical support for the head.

7. In a gyratory crusher, a crusher frame, an upstanding element on said frame having a generally cylindrical generally vertical exterior side bearing surface, an eccentrically apertured sleeve surrounding and conforming to said exterior bearing surface, and means for rotating it, said sleeve having exterior and interior generally cylindrical bearing surfaces, the axes of which are inclined to each other, and a head having a bearing surface surrounding and conforming to the exterior bearing surface of the eccentric sleeve, supporting means for said head, including an upwardly concave spherical bearing element supported by the frame and located exteriorly of said eccentrically apertured sleeve and at a level generally midway between the upper and lower ends of the bearing surface of the head which surrounds the exterior bearing surface of the eccentric sleeve, and a downwardly convex spherical bearing element conforming thereto and associated with the head, said upwardly concave spherical bearing element constituting the sole vertical support for the head.

8. In a gyratory crusher, a crusher frame, an upstanding element on said frame having a generally cylindrical generally vertical exterior side bearing surface, an eccentrically apertured sleeve surrounding and conforming to said exterior bearing surface, and means for rotating it, said sleeve having exterior and interior generally cylindrical bearing surfaces, the axes of which are inclined to each other, and a head having a bearing surface surrounding and conforming to the exterior bearing surface of the eccentric sleeve, supporting means for said head, including an upwardly concave spherical bearing element supported by the frame and located exteriorly of said eccentrically apertured sleeve, and constituting the sole vertical support for the head, and a downwardly convex spherical bearing element conforming thereto and associated with the head, said head having a downwardly and outwardly

extending portion having a downwardly convex spherical bearing surface concentric with the first mentioned spherical bearing surface of the head but of greater radius, and a sealing member mounted on the frame and opposed thereto.

9. In a gyratory crusher, a crusher frame, an upstanding element on said frame having a generally cylindrical generally vertical exterior side bearing surface, an eccentrically apertured sleeve surrounding and conforming to said exterior bearing surface, and means for rotating it, said sleeve having exterior and interior generally cylindrical bearing surfaces, the axes of which are inclined to each other, and a head having a bearing surface surrounding and conforming to the exterior bearing surface of the eccentric sleeve, supporting means for said head, including an upwardly concave spherical bearing element supported by the frame and located exteriorly of said eccentrically apertured sleeve and constituting the sole vertical support for the head, and a downwardly convex spherical bearing element conforming thereto and associated with the head, said head having a downwardly and outwardly extending portion having a downwardly convex spherical bearing surface concentric with the first mentioned spherical bearing surface of the head but of greater radius, a sealing member mounted on the frame and opposed thereto, and means for yieldingly urging said sealing member into sealing contact with said last mentioned downwardly convex spherical bearing surface.

10. In a gyratory crusher, a crusher frame, an upstanding element on said frame having a generally cylindrical generally vertical exterior side bearing surface, an eccentrically apertured sleeve surrounding and conforming to said exterior bearing surface, and means for rotating it, said sleeve having exterior and interior generally cylindrical bearing surfaces, the axes of which are inclined to each other, and intersect above the top of the sleeve, and a head having a bearing surface surrounding and conforming to the exterior bearing surface of the eccentric sleeve, supporting means for said head, including an upwardly concave spherical bearing element supported by the frame and located radially exteriorly of said eccentrically apertured sleeve, and a downwardly convex spherical bearing element conforming thereto and associated with the head, said upwardly concave spherical bearing element constituting the sole vertical support for the head, the center about which is described the spherical bearing surface of said upwardly concave bearing element being at the point of intersection of the axes of the exterior and interior bearing surfaces of the sleeve.

11. In a gyratory crusher including a main frame and a bowl portion mounted on said frame, a normally fixed shaft mounted in said main frame, said main frame having an upstanding fixed sleeve in which said shaft is mounted, an eccentrically apertured sleeve surrounding said shaft and in bearing relation therewith, and means for rotating it, and a head surrounding said eccentric sleeve and in bearing relation to the exterior thereof, supporting means for said head including an upwardly concave spherical bearing on the frame, the eccentric sleeve constituting the sole means for limiting lateral movement of the head in relation to the bowl portion, said eccentric sleeve including a portion extending downwardly about the exterior of said fixed sleeve of the main frame and being adapted, in the event of the breakage of said shaft, to contact the opposed portion of the fixed sleeve prior to damaging engagement of the head with any other part of the crusher, and to prevent substantial lateral movement of said eccentric sleeve.

12. In a gyratory crusher including a main frame and a bowl portion mounted on said main frame, a normally fixed shaft mounted in said main frame, said main frame having an upstanding fixed sleeve in which said shaft is mounted, an eccentrically apertured sleeve surrounding said shaft and in bearing relation therewith, and means for rotating it, and a head surrounding said eccentric sleeve and in bearing relation to the exterior thereof, supporting means for said head, the eccentric sleeve constituting the sole means for limiting lateral movement of the head in relation to the bowl portion, said eccentric sleeve including a portion extending downwardly about the exterior of said fixed sleeve of the main frame and being adapted in the event of the breakage of said shaft to contact the opposed portion of the fixed sleeve prior to damaging engagement of the head with any other part of the crusher, and to prevent substantial lateral movement of said eccentric sleeve, and sealing means between a lower portion of the head and the main frame, including opposed sealing faces on head and frame, conforming to the normal path of head movement, the head being free to slide over said sealing face on the frame a distance greater than the range of movement permitted by the clearance between the eccentric sleeve and the fixed sleeve of the main frame in the event of breakage of said shaft.

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