April 29, 1958 J. E. KENNEDY 2,832,547

GEARED GYRATORY CRUSHERS

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Fig. 1.

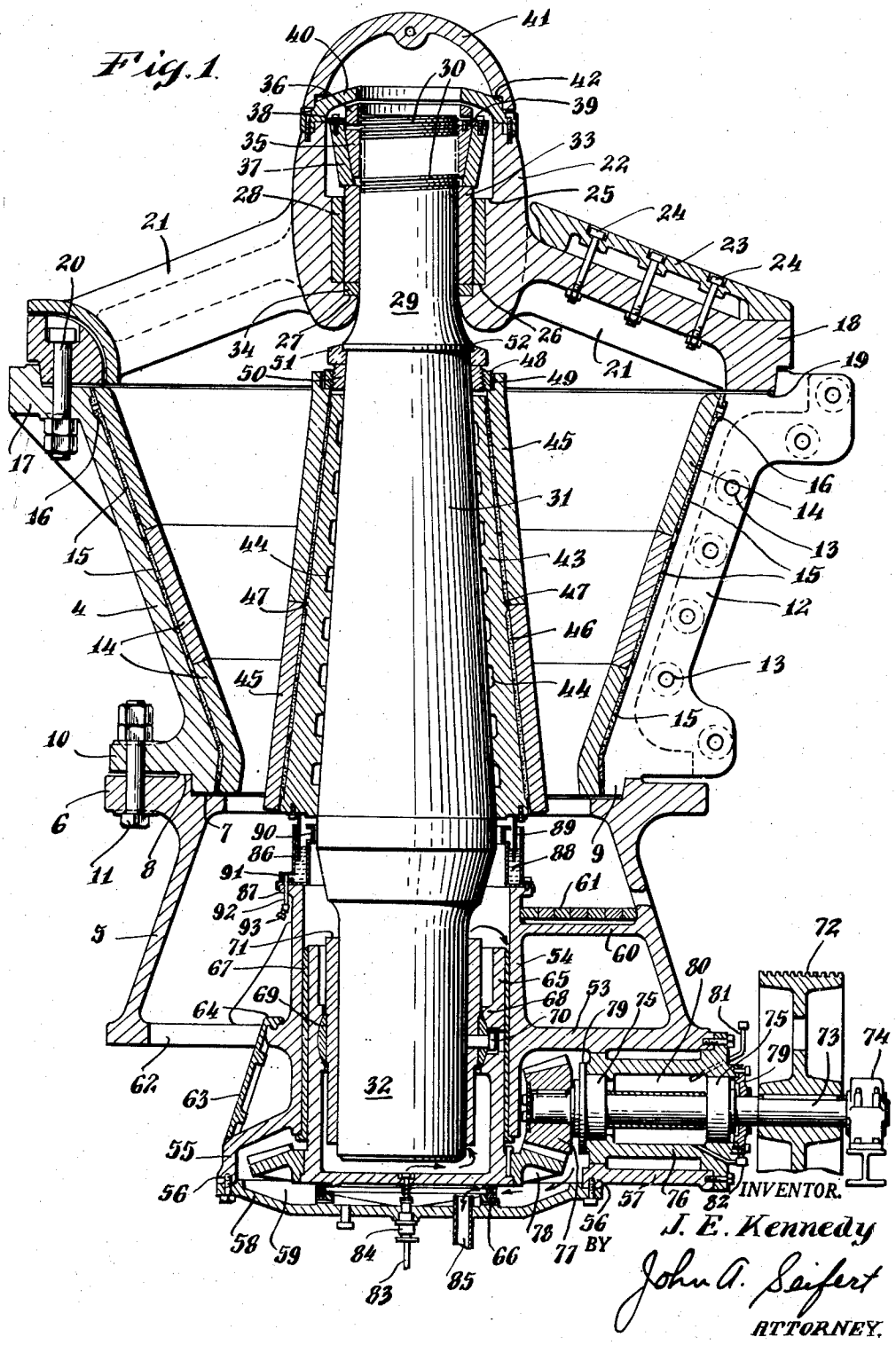

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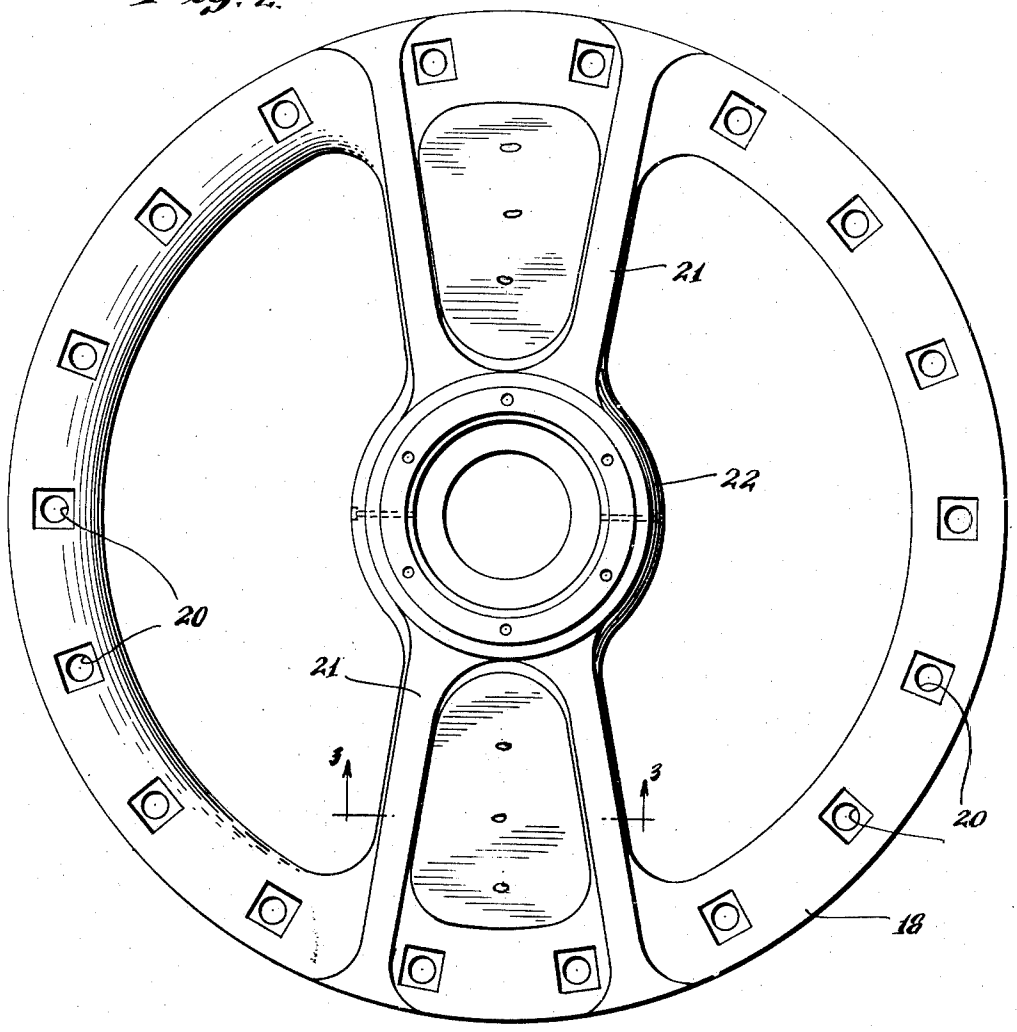
Fig. 2.



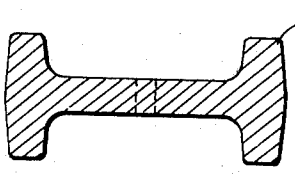


Fig. 3.

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GEARED GYRATORY CRUSHERS

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3 Claims. (Cl. 241—209)

This invention relates to gyratory crushers and particularly to crushers of this type wherein the eccentric is rotated from a source of power through a meshing gear and pinion and known as a geared gyratory crusher.

An object of the present invention is to rigidly support the eccentric by the frame of the crusher and prevent undue vibration of the eccentric.

It is another object of the invention to provide a rigid support in the crusher frame for a counter shaft connecting the eccentric to a source of power.

It is another object of the invention to provide a lubricant chamber in the portion of the crusher frame supporting the eccentric and counter shaft.

Another object of the invention is to provide a crushed material discharge opening in a bottom wall of the crusher frame and a chute supported by said bottom wall and lubricant chamber.

Other objects and advantages of the invention will be described hereinafter.

The drawings accompanying and forming a part of this application comprises:

Figure 1 showing a longitudinal-sectional view of the crusher;

Figure 2 showing a top view, on an enlarged scale, of the spider of the crusher; and

Figure 3 is a sectional view taken on the line 3—3 of Figure 2 looking in the direction of the arrows of an arm of the spider.

The embodiment of the invention includes a hollow crusher frame comprising an upper frame member 4 and a lower frame member 5 supported on a suitable foundation, not shown. The upper end of the lower frame member is arranged with an annular flange 6 and an annular seat 7 forming a shoulder at the inner circumference of the flange to engage and support a corresponding annular recess at the lower end of the upper frame member 4, as shown at 8 in Figure 1. The lower end of the upper frame member 4 is provided with an annular depending portion 9 to fit within the seat 7 and an annular flange 10 to extend parallel with the flange 6. Both flanges 6 and 10 have a plurality of aligned openings for the engagement of bolts 11 to secure together the upper and lower frame members.

The upper frame member tapers from the top to the bottom and is longitudinally split and arranged with a flange 12 at each split edge and the flanges 12 are provided with aligned openings 13 for the engagement of bolts for drawing the upper frame member around a crushing concave mounted in said upper frame member. The crushing concave comprises a plurality of tapering annular sections 14 with each section secured to the upper frame member by zinc, as indicated at 15, and the zinc of the top crushing concave section having an anchoring projection 16 into the upper frame member, as shown in Figure 1.

The upper end of the upper frame member 4 is arranged with an annular flange 17 provided with an annular seat in the upper face for the engagement and support of a corresponding ridge in the underface of a rim 18 of a spider, as shown at 19 in Figure 1. The flange 17 and rim 18 are provided with aligned openings for the engagement of a plurality of bolts to secure the spider to the upper frame member, as shown at 20.

The spider member also includes two arms 21 extending inwardly from diametrically opposite portions of the rim 18 to diametrically opposite portions of a hub portion 22. The arms 21 are of H-shape in cross section, as shown in Figure 3, to reduce the weight of the spider. The material to be crushed is fed into the upper frame member through the spaces between the spider arms, and to protect the arms from damage by the material being fed into the crusher, plates 23 are secured in the upper hollow spaces of the arms by bolts 24, as shown in Figure 1. The hub portion 22 is provided with three annular internal seats 25, 26 and 27, as shown in Figure 1. An annular bearing or bushing 28 is engaged on the annular seat 26 to occupy the inner portion of the hub between the seats 25 and 26 and provide a bearing surface for a gyratory shaft.

The gyratory shaft is provided with a straight wall upper end portion 29 having screw threads 30 at the upper extremity, a conical intermediate portion 31 and a straight wall lower end portion 32, as shown in Figure 1. The straight upper end portion 29 is fitted with a bearing sleeve 33 tapering from the bottom to the top to permit gyratory movement of the gyratory shaft within the bearing 28. The bottom of the bearing sleeve 33 is supported by a bearing ring 34 fitted in the hub seat 27. The top portion of the bearing sleeve 33 is extended above the bearing 28 and screwed on the screw threads 30 to support the gyratory shaft on the bearing ring 34, as shown in Figure 1. The bearing sleeve 33 is locked on the gyratory shaft by a self-tightening lock-nut comprising a body portion 35 screwed on the screw threads 30 and having a downwardly tapering outer wall and a horizontally split annular portion 36 at the upper end of the body portion 35 and of larger diameter than the screw threaded end 30 of the gyratory shaft. The lock-nut is made self-locking by a conical or tapering annular member 37 encircling the nut body 35 with the lower end abutting the upper end of the bearing sleeves 33 and the upper end connected to the nut body 35 by a ring 38 secured to the upper end of the member 37 and having a lateral extension extended in the space between the nut body 35 and split portion 36 and secured to the nut body 35, as shown at 39 in Figure 1. Undue upward movement of the split portion 36 is limited by a perforated cap plate 40 secured to the top of the hub portion 22. Dust and dirt are prevented from accumulating on the plate 40 and in the hub portion 22 by a dust cap 41 mounted on the plate 40 with an angular sealing joint 42 between the cap 41 and plate 40, as shown in Figure 1.

The conical shaft portion 31 is provided with a crushing head comprising a conical core 43 having spaced annular grooves 44 in the wall of the bore to form a gripping surface to retain the core on the conical portion 31 and reduce the weight of the head, and a plurality of annular-conical crushing members 45 secured on the core 43 by poured zinc 46. To increase the bond between the core 43 and the crushing members 45, the portion of the core adjacent the joint between the crushing members 45 is provided with an annular ridge 47 extending into the zinc 46, as shown in Figure 1. The crushing head is retained on the conical shaft portion by a nut 48 engaged in an annular recess 49 in the top of the upper crushing member 45 and screwed on a ring 50 wedged onto the conical shaft portion 31 by a clamping

collar 51 abutting an annular ridge 52 formed on the gyratory shaft between the upper shaft end portion 29 and the conical shaft portion 31, as shown in Figure 1.

The crushing concave sections 14 and the crushing members 45 form a crushing chamber tapering downward from a wide entrance end at the top to a narrow outlet end at the bottom, as shown in Figure 1.

The lower frame member 5 is arranged to eccentrically support the lower shaft end portion 32 and rigidly support driving means. This is accomplished by providing said lower frame member 5 with a bottom horizontal wall 53 having an integral bearing sleeve 54 in the center of said bottom wall and extending from the opposite faces of the bottom wall, as shown in Figure 1. The lower portion of the bearing sleeve 54 below the bottom wall 53 is arranged with an enlarged depending member 55 forming an annular rim 56 with a horizontal-tubular housing 57 formed integral with the underface of the bottom wall 53 in spaced relation to one side of the bearing sleeve 54. The opening formed by the rim 56 is closed by a closure plate 58 removably secured to said rim, as shown in Figure 1. A chamber 59 is formed by the enlarged depending portion 55, the tubular housing 57 and the closure plate 58. The lower frame member 5 is arranged with four radial ribs 60 between the outlet of the crushing chamber and the bottom wall 53 to support a wear-resisting shelf 61 to receive crushed material from the crushing chamber outlet and guide said crushed material to a crushed material discharge opening 62 in the portion of the bottom wall on the side of the sleeve bearing 54 opposite the side arranged with the tubular housing 57. To prevent the crushed material from damaging the enlarged depending member 55 and provide a chute, a plate 63 is provided with a tongue at one end engaged in a groove in the bottom wall 53 adjacent the opening 62 to secure the plate to the bottom wall 53, as shown at 64 in Figure 1, and the opposite end of the plate 63 resting on a shoulder of the enlarged depending member 55.

The bearing sleeve 54 eccentrically supports the gyratory shaft by an eccentric comprising a cup-shaped member 65 rotatable in the bearing sleeve 54 with the closed end portion of the member 65 extending below the bearing sleeve 54 and into the chamber 59 with the closed end rotatably supported by an annular ball bearing race 66 on the interior of the closure plate 58. To reduce friction between the cup-shaped member 65 with the bearing sleeve 54, the portion of the interior of the bearing sleeve occupied by the cup-shaped member is provided with a bearing lining 67. The interior of the cup-shaped member 65 is provided with an annular eccentric socket portion 68 for the engagement of an annular ball member 69 releasably mounted by a pin 70 on a sleeve 71 engaged on the lower shaft end portion 32, as shown in Figure 1. The rotation of the cup-shaped member 65 will gyrate the shaft 29—32 and crushing head 43—45 through the eccentric socket portion 68 and ball member 69.

The cup-shaped member is rotated from a suitable source of power, such as an electric motor, not shown, through a pulley 72 keyed to an end portion of a counter shaft 73 rotatably supported at an end projecting from the pulley by a bearing 74 mounted exteriorly of the crusher. A greater portion of the shaft 73 is rotatably supported by bearings 75 mounted in the opposite ends of a bearing cylinder 76 removably secured in the tubular housing 57. An end portion of the shaft 73 extending into the chamber 59 is provided with a beveled pinion 77 keyed to said end portion of the shaft and meshing with an annular beveled gear 78 keyed to the closed end portion of the cup-shaped member 65 within the chamber 59. The removable mounting of the bearing cylinder 76 permits ready replacement of the shaft 73 and pinion 77 and the gear 78 is readily replaced by the removal of the closure plate 58, whereby the driving mechanism can be replaced without dismantling the entire crusher.

The bottom wall 53 and the integral bearing sleeve 54 and tubular housing 57 provide a rigid mounting for the eccentric 65—71 and drive mechanism 72—78.

The bearing cylinder 76 is sealed at the ends by glands 79 to form a lubricant chamber 80 having a lubricant inlet 81 and sediment outlet 82.

The eccentric mounting 65—71, pinion 77 and gear 78 are forced lubricated from a lubricating pump, not shown, connected to a pipe 83 rotatably mounted in a bushing 84 mounted in the closure plate 58. The end of the pipe 83 is extended through the closed end of the cup-shaped member 65 whereby the lubricant flows in the direction of the arrows up the shaft portion 32 and the sleeve 71, down the cup-shaped member 65 and the bearing sleeve 54, between the pinion 77 and gear 78 and through the ball bearing race 66 to a return pipe 85 in the closure plate 58.

To prevent dust and fragments of the crushed material from entering the bearing sleeve 54 and damaging the eccentric mounting, there is provided a dust seal comprising an annular channel member 86 mounted on a flange 87 at the upper end of the bearing sleeve 54. The channel member is partially filled with a liquid, such as water or oil, as shown at 88 in Figure 1, and an annular plate 89 having a flanged upper end secured to the lower end of the crushing head core 43 is extended into the liquid in spaced relation to the walls of the channel member 86, as shown in Figure 1. The wall 89 is near the outer wall of the channel member 86 and the upper portion of the inner wall of the channel member is offset outwardly toward the gyratory shaft to effect a better sealing of the bearing sleeve 54, as shown at 90 in Figure 1. The channel member 86 is provided with drainage means in the form of an outwardly extending pocket 91 having an outlet 92 arranged with a nipple 93 for connection of a hose, not shown, for circulation of the sealing liquid through a filter and pump, not shown, so that any deposits of dust in the channel member 86 can be flushed out. This prevents formation of a cake of sealing liquid and dust.

Having thus described my invention, I claim:

1. A gyratory crusher including a hollow frame supported in upright position, a spider mounted on the upper end of the frame and having a bearing in the center thereof, a crushing concave mounted in the upper portion of the frame, a tubular eccentric mounted in the lower portion of the frame, a gyratory shaft supported at the opposite end portions in the spider bearing and the eccentric, and a crushing head secured to an intermediate portion of the gyratory shaft to form a crushing chamber with the crushing concave, the improvement being in the hollow frame and comprising an upper frame member supporting the spider and the crushing concave, and a lower frame member supporting the upper frame member and having a horizontal wall at the bottom edge of the lower frame member closing the bottom portion of the lower frame member and arranged with a discharge opening on one side of the vertical axis of the lower frame member, a bearing sleeve integral with the bottom wall and extending from the opposite faces of said bottom wall to form a bearing for the eccentric with the lower portion of the eccentric extending below the bearing sleeve, a horizontal tubular housing on the underface of the bottom wall and at one side of the lower portion of the bearing sleeve opposite the discharge opening in the horizontal wall and positioned entirely outside the lower frame member, and a counter shaft rotatably supported in the tubular housing in a horizontal plane below the bottom edge of the lower frame member and having one end extending exteriorly of the housing and operatively connected to a source of power and the opposite end operatively connected to the lower portion of the eccentric.

2. A gyratory crusher as claimed in claim 1, wherein

the bearing sleeve is arranged with an enlarged depending member having a shoulder and positioned entirely out of the lower frame member, and a plate secured at one end to the horizontal wall adjacent the discharge opening and the opposite end resting on the shoulder of the enlarged depending member to form a chute for the crushed material with a substantial portion positioned out of the lower frame member.

3. A gyratory crusher as claimed in claim 1, wherein the eccentric is cup-shaped with the closed bottom extending below the bearing sleeve, the lower portion of the bearing sleeve is arranged with an enlarged depending member forming a rim with the tubular housing, a closure plate secured to the rim to form a chamber below and around the lower portion of the bearing sleeve, a conduit for lubricant rotatably mounted in the closure plate and extended through the closed bottom of the eccentric to lubricate the eccentric and bearing sleeve, and a lubricant outlet in the closure plate.

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