Aug. 11, 1925. 1,549,641

W. S. WESTON

GYRATORY CRUSHING MACHINE

Filed Jan. 7, 1922 2 Sheets-Sheet 1

FIG. 1.

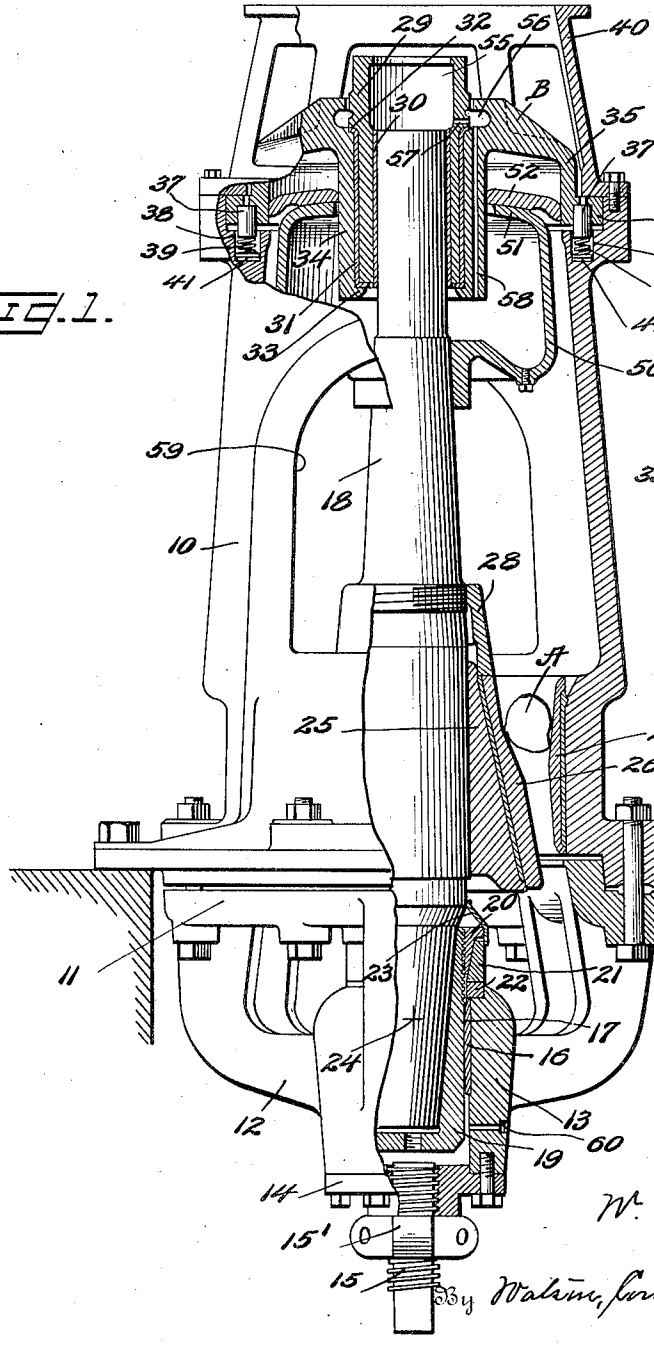
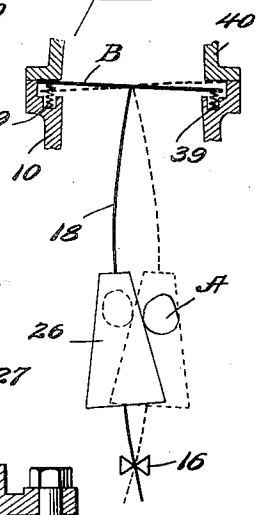


FIG. 6.



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FIG. 2.

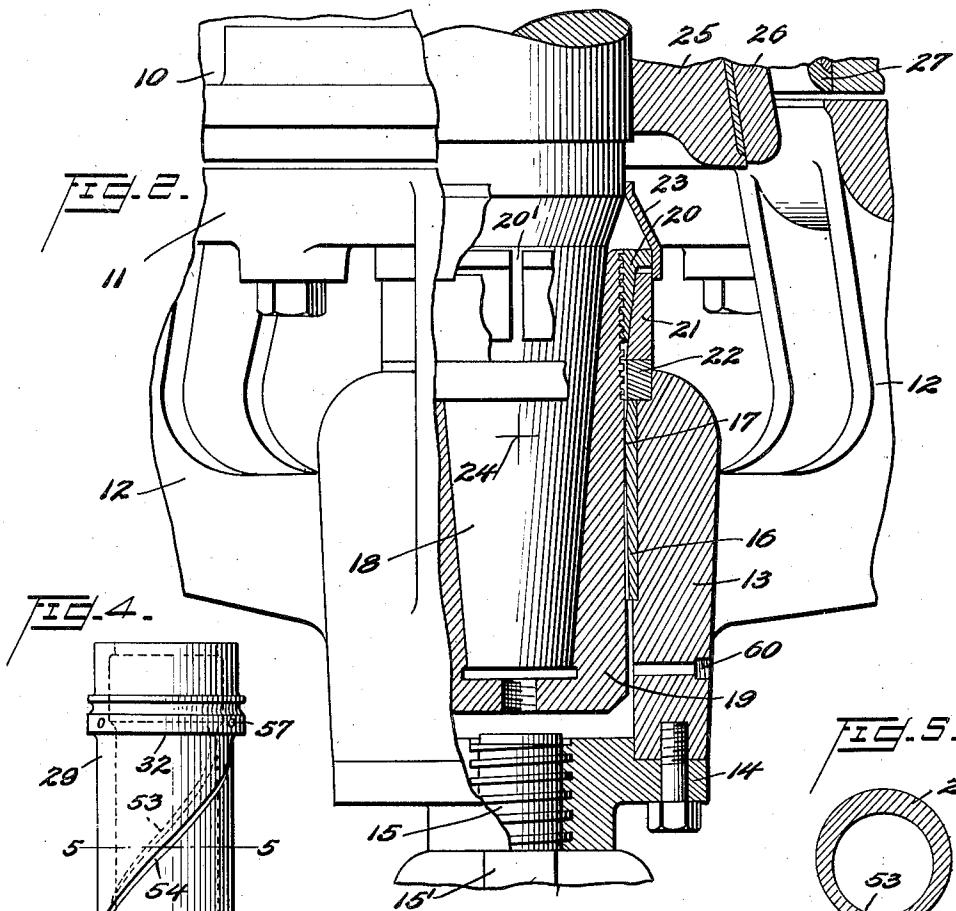
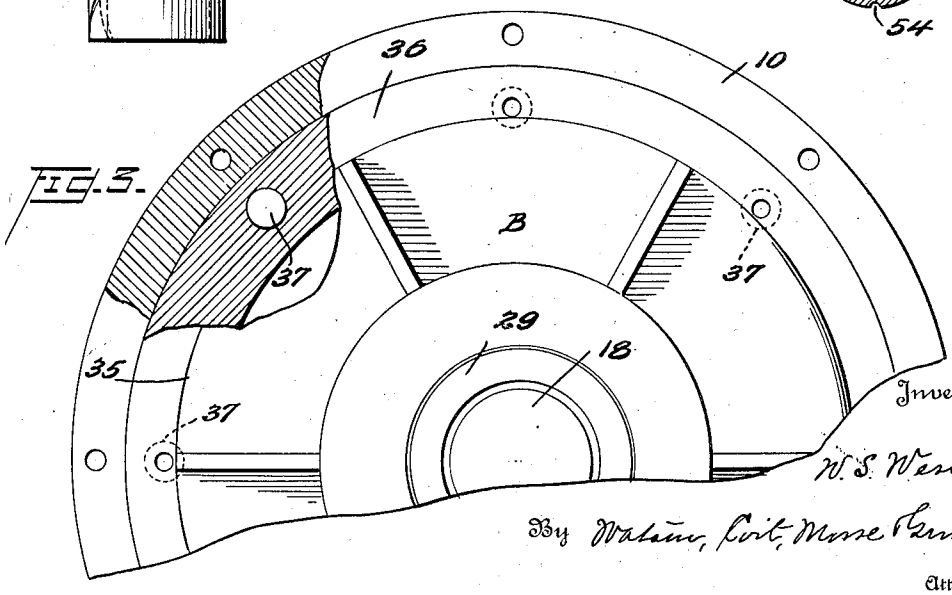


FIG. 4.

FIG. 5.

FIG. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM S. WESTON, OF COLUMBIA, SOUTH CAROLINA, ASSIGNOR TO WESTON AND BROOKER, ENGINEERS, OF COLUMBIA, SOUTH CAROLINA, A PARTNERSHIP COMPOSED OF W. S. WESTON, T. I. WESTON, AND B. O. BROOKER.

GYRATORY CRUSHING MACHINE.

Application filed January 7, 1922. Serial No. 527,648.

To all whom it may concern: .

Be it known that I, WILLIAM S. WESTON, a citizen of the United States, and residing at Columbia, Richland County, State of South Carolina, have invented certain new and useful Improvements in Gyratory Crushing Machines, of which the following is a specification.

This invention relates to gyratory crushing machines.

In my copending application, Serial No. 456,663, filed March 29, 1921, is disclosed a gyratory crusher having a number of novel features of construction, and the present invention contemplates in a gyratory crusher of the same general type as that disclosed in the above mentioned application, a number of further improvements including among them a supporting bearing for the eccentric which is simple and which eliminates frictional losses, so that a saving in the cost of construction results, a saving in operating expense, and a reduction in the weight of the machine effected. The manner in which the shaft is supported in the present invention is also important, the shaft being arranged to gyrate about a point relatively close to the movable crushing head, and being supported in such manner as to be readily adjustable in a vertical direction. Other novel features of the invention will be pointed out.

In the drawings:

Figure 1 is a side elevation of the crusher, partially broken away to show the interior construction;

Figure 2 is an enlarged side elevation of the bottom of the machine, partially broken away;

Figure 3 is a partial plan view of the machine, certain parts being removed and the bearing member being partially broken away;

Figure 4 is a side elevation of the eccentric;

Figure 5 is a section on line 5—5 of Figure 4; and

Figure 6 is a diagram of the shaft and bearing showing two positions of these members.

The frame comprises the substantially cylindrical main portion 10, which is supported upon concrete foundations, and the bottom removable portion 11 which is bolted to the under side of the portion 10. The bottom 11 comprises a spider, having radial legs 12 which support a central hollow cylindrical member 13. Member 13 has its bottom closed by a cap 14 and a screw 15 extends through a threaded aperture in this cap for a purpose hereinafter to be explained. Within the upper end of the cylindrical cavity in member 13 is a bushing 16 having a cylindrical outer surface and a double conical inner surface, the inner wall of this bushing flaring from annular ridge 17 toward each end.

The main shaft is indicated at 18 and this shaft has a tapering lower end which enters a correspondingly tapered central opening in a cap 19. This cap 19 has a cylindrical outer surface having a diameter substantially equal to the inner diameter of bushing 16 at ridge 17 and is threaded externally adjacent its upper end to receive the correspondingly threaded bushing 20, the outer surface of which tapers downwardly and which is axially split at 20′. The downwardly tapering outer surface of bushing 20 is received within the correspondingly tapered inner surface of a collar 21 the lower end of which rests in turn upon a wearing ring 22 supported upon the outer end of member 13. A dust cap 23 is provided for preventing entrance of dust into the threaded joint between bushing 20 and cap 19. As the shaft is gyrated, by an eccentric at its upper end, its motion is centered about the point 24 substantially opposite the ridge 17 of the bushing 16.

Fixed upon the shaft a relatively short distance above the point of gyration is a supporting cone 25 which bears the crushing cone 26 which in turn cooperates with the hopper or concave 27 in the crushing of rocks which pass downwardly between them. A frustro conical space between the supporting cone 25 and crushing cone 26 is filled with zinc and a cap 28 having threaded engagement with the shaft 18 has its lower end in contact with the outer surface of the top of cone 25 and the upper surface of crushing cone 26 to prevent the escape of any of the zinc filling from between the two cones in the operation of the machine.

The upper end of the shaft is received within an eccentric aperture in a cylindrical bushing 29 which aperture is lined with

babbitt or other anti-friction metal 30. The bushing 29, hereinafter called the eccentric, is rotatably supported centrally in a bearing B and a second bushing, of babbitt is interposed between the eccentric and bearing. The annular shoulder 32 of the eccentric 29 rests upon the upper end of bushing 31 of the bearing B and the lower end of the eccentric rests upon the annular inturned lower flange of this bushing.

The bearing B comprises, in addition to the cylindrical central portion 34, an outer bell shaped portion 35 which terminates in an annular ring 36. This ring fits with a slight horizontal clearance in an annular groove in the upper end of the frame 10. The annular ring 36 is provided with a number of inserted pins 37 which extend downwardly into pockets 38 of slightly larger diameter formed in frame 10 and opening into the groove in which ring 36 is received. Interposed between the lower end of each of these pins and the bottom of the corresponding pocket 38 is a coiled spring 39 and these springs exert a combined lifting force on the bearing sufficient to maintain the upper annular face of ring 36 in contact with the annular lower shoulder of a pedestal 40 bolted to the top of frame 10. This pedestal may support an electric motor or power element for driving the eccentric 29. If found to be necessary shims 41 may be placed in the bottoms of pockets 38 to shorten springs 39 to thereby increase the force exerted by these springs against the bottoms of pins 37. Pins 37 prevent relative rotation of bearing B and frame 10.

Supported on shaft 18 below the lower end of the eccentric is an oil reservoir 50 which has a substantially cylindrical side wall with its upper margin 51 turned inwardly and the inner edge of this inturned portion being circular and closely adjacent the outer wall of the cylindrical portion 34 of the bearing. There is a sufficient clearance between this edge and the outer wall of portion 34 to prevent contact between the oil reservoir and the bearing as the shaft gyrates, the bearing being stationary and the oil reservoir moving with the shaft. The upper surface of portion 51 of the oil reservoir is spherical, this surface being centered about point 24 and an annular dust cap 52 resting thereon has a similarly formed lower surface. The outer and inner edges of the substantially horizontal dust cap fit closely against the inner wall of the bell-like portion 35 of the bearing and the cylindrical outer wall of portion 34, thereof so that there is no possibility of dust, created in the crushing operations of the jaws, passing around the dust cap 52 and into the oil reservoir 50.

The level of the oil in the reservoir is such that the bottom of the eccentric 29 is always submerged, and the inner and outer surfaces of this eccentric are provided with spiral grooves 53 and 54 respectively, which grooves assist in moving oil upwardly from the oil reservoir along the inner and outer surfaces of the eccentric to the oil cup 55 in the top of the eccentric, and the annular oil chamber 56 in the top of the bearing B, respectively. Oil passing upwardly between the eccentric and the shaft and into cup 55 will flow through aperture 57 into the annular chamber 56 and this oil, and also the oil passing directly into this annular chamber after having passed between the eccentric 29 and bearing B, flows downwardly through duct 58 and returns to the oil reservoir 50. The spiral grooves 53 and 54 greatly assist in the elevation of the oil along the bearing surfaces of the eccentric, and if desired a plurality of such grooves may be employed, but in some instances their use may be unnecessary, oil flowing upwardly along the bearing surfaces due to the pumping action of the eccentric.

In the operation of the device the rocks to be crushed are introduced through the openings 59 and pass downwardly between the crushing cone and the crushing hopper, the crushed material falling to a receiving bin beneath the machine. Crushing the larger and harder rocks will often cause flexure of the crushing shaft 18. Assuming for instance, that the crusher is engaged in reducing a large rock A it will be seen that the center of the shaft will flex slightly toward the left, the shaft being held against horizontal movement at both top and bottom, the bottom of the shaft bearing against bushing 16 and the top against the eccentric. The rim 36 of bearing B bears against the side of the groove formed in member 10 which receives it, the point of contact being diametrically opposite the stone being crushed. The horizontal clearance between rim 36 and frame 10 is then all at the right hand side and the bearing B is free to frictionlessly tilt about its left hand point of contact with the frame to allow free flexure of the shaft 18.

In Figure 6 the bearing and shaft are diametrically represented and the flexure of the shaft exaggerated. The point of contact between rim 36 and frame 10 changes constantly, being always on the side of shaft 18 which is opposite the rock being crushed. Until the shaft is flexed in this manner the springs 38 maintain the rim 36 in contact with member 40 and the bearing B in horizontal position. In other forms of bearings heretofore designed or suggested considerable friction has existed between the bearing and the supporting frame when the shaft has been flexed. A great advantage of the present invention is that this friction is obviated, with the results that less power

is required to operate the machine and the parts are not quickly worn out.

As it is sometimes desired to vertically adjust the shaft 18, the screw 15 is provided. This screw is normally held by a lock nut 15′ in the position in which it is shown in Figure 1, but when a shaft adjustment is to be made, the screw is advanced to exert a pressure on the bottom of cap 19 sufficient to lift the entire shaft. A wedge is then driven into the groove between the upper edge of collar 21 and the lower edge of the annular upper rim of tapered bushing 20. This results in the separation of these parts, the collar 21 dropping to rest on ring 22, and it is then an easy matter to vertically move the bushing 20 by rotating it and to then drop the shaft until this bushing is again resting on the collar.

When the machine is running idly that portion of bushing 16 which lies above ridge 17 serves to prevent lateral movement of the lower end of the shaft due to the forces of inertia of the gyrating parts. When however, the shaft is under strain, as when it is engaged in crushing operations, the pressure of the cap 19 is exerted against that portion of the bushing 16 which lies below the contracted section 17. The bushing 16 thus presents a large bearing area for the shaft when such area is needed to resist strain and a small bearing area when the forces exerted against the bushing are relatively small. Lubricant may be introduced into the space between cap 19 and bushing 16 through the aperture 60 in member 13.

To one skilled in the art the advantages of the above described crusher will be apparent. The crusher will operate rapidly and with a minimum of frictional loss, is easily adjusted and is comparatively light in weight for a machine of its class. Obviously the principle of the invention may be embodied in different forms and the invention is not limited in its scope to the specific structure herein disclosed.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame, said bearing being adapted to tilt, when the shaft is flexed, about an axis to one side of the center of the shaft.

2. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame and adapted to have rolling contact therewith as the shaft gyrates so that the bearing may tilt when the shaft flexes.

3. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame, said bearing being adapted to tilt as the shaft flexes, about an axis through a point of contact between the bearing and frame and to on side of the shaft.

4. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame and having a limited movement relatively thereto in a direction transverse to the shaft so that the bearing and eccentric may tilt when the shaft is flexed.

5. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame for limited movement relatively thereto in a direction transverse to the shaft, said bearing being adapted to tilt, as the shaft flexes, about an axis to one side of the center of the shaft.

6. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame, said bearing having a circular rim adapted to engage the frame at a point diametrically opposite the crushing point and to tilt about an axis through said point of engagement when the shaft flexes.

7. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, a bearing supporting the eccentric in the frame, said bearing being adapted to tilt, when the shaft is flexed, and means opposing the tilting of the bearing.

8. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, a bearing supporting the eccentric in the frame, said bearing being adapted to tilt when the shaft is flexed, and spring means opposing the tilting movement of the bearing and normally holding the same in a predetermined position.

9. In a gyratory crushing machine, in combination, a frame, a substantially vertical gyratory shaft, and means for adjustably supporting the shaft in the frame including

a ring having threaded engagement with the shaft and having a downwardly tapering outer surface, and a collar having an upwardly flaring aperture to receive the ring, said collar slidably resting on the frame and being unconfined against lateral movement.

10. In a gyratory crushing machine, in combination, a frame, a substantially vertical gyratory shaft, and means for adjustably supporting the shaft in the frame including an axially split ring having threaded engagement with the shaft and having a downwardly tapering outer surface, and a collar having a correspondingly tapered upwardly flaring aperture to receive the ring, said collar slidably resting on the frame.

11. In a gyratory crushing machine, in combination, a frame, a vertical shaft, an eccentric engaging one end of the shaft for gyrating the same, and a sleeve or bushing into which the other end of the shaft extends, said bushing being rigidly supported in the frame and its inner wall having two conical sections, one section flaring toward the upper end of the bushing and the other section flaring toward the lower end of the bushing.

12. In a gyratory crushing machine, in combination, a frame, a vertical shaft, an eccentric engaging one end of the shaft for gyrating the same, and a sleeve or bushing into which the other end of the shaft extends, said bushing being rigidly supported in the frame and its inner wall having two conical sections which meet in an intermediate crest or ridge, the diameter of each section of the bushing increasing with the distance from the intermediate ridge.

13. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame, said bearing comprising a central cylinder within which the eccentric is rotatably mounted, and an annular flange concentric therewith, the frame having an annular recess of slightly greater diameter than said flange within which the flange lies, the bearing being tiltable relatively to the frame about the point of contact between the flange and recess, for the purpose set forth.

14. In a gyratory crushing machine, in combination, a frame having its axis vertically disposed, a substantially vertical shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, and a bearing supporting the eccentric in the frame, said frame having a cylindrical inwardly facing wall or bearing surface coaxial with the frame and said bearing having an outwardly facing cylindrical bearing wall concentric with the bearing the diameter across the cylindrical wall of the frame being slightly greater than the diameter across the cylindrical wall of the bearing, the bearing being tiltable relatively to the frame about the point of contact between the flange and recess for the purpose set forth.

15. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, a bearing supporting the eccentric in the frame, said bearing comprising a central cylinder within which the eccentric is rotatably mounted, and an annular flange concentric therewith and engaging the frame, the bearing being tiltable relatively to the frame about the point of contact between said annular flange and the frame, and means engaging said annular flange and the frame for preventing rotation of the bearing relatively to the frame.

16. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, a bearing supporting the eccentric in the frame, said bearing comprising a central cylinder within which the eccentric is rotatably mounted, and an annular flange concentric therewith and engaging the frame, the bearing being tiltable relatively to the frame about the point of contact between said annular flange and the frame, and plungers extending into registering apertures in the flange and frame to prevent rotation of the bearing in the frame.

17. In a gyratory crushing machine, in combination, a frame, a shaft supported in the frame for gyratory movement, an eccentric engaging one end of the shaft for gyrating the same, a bearing supporting the eccentric in the frame, said bearing comprising a central cylinder within which the eccentric is rotatably mounted, and an annular flange concentric therewith and engaging the frame, the bearing being tiltable relatively to the frame about the point of contact between said annular flange and the frame, plungers extending into registering apertures in the flange and frame to prevent rotation of the bearing in the frame, and springs acting axially on said plungers from below to thereby exert upward forces on said bearing.

In testimony whereof I hereunto affix my signature.

WILLIAM S. WESTON.