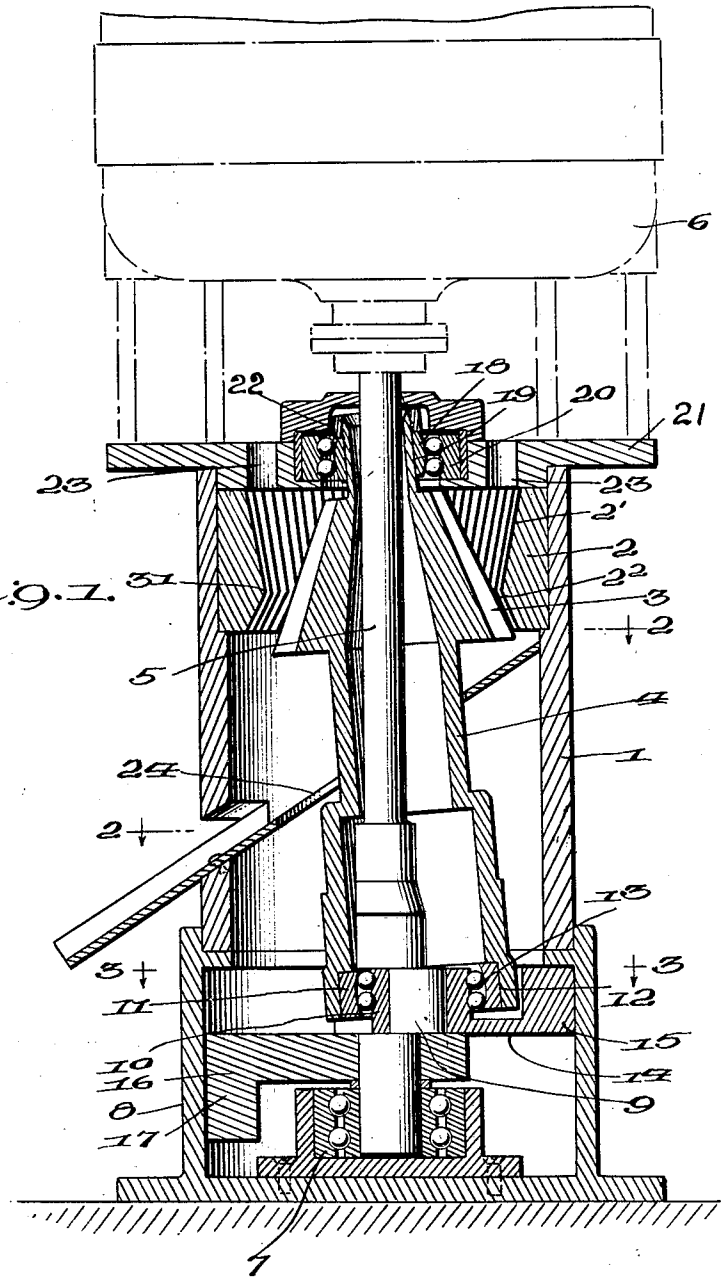
Nov. 28, 1933. J. A. McCASKELL 1,936,728

DEVICE FOR CRUSHING AND PULVERIZING ORE AND OTHER REFRACTORY MATERIAL

Filed May 12, 1931 4 Sheets-Sheet 1

Fig. 1.



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DEVICE FOR CRUSHING AND PULVERIZING ORE AND OTHER REFRACTORY MATERIAL

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Fig. 2.

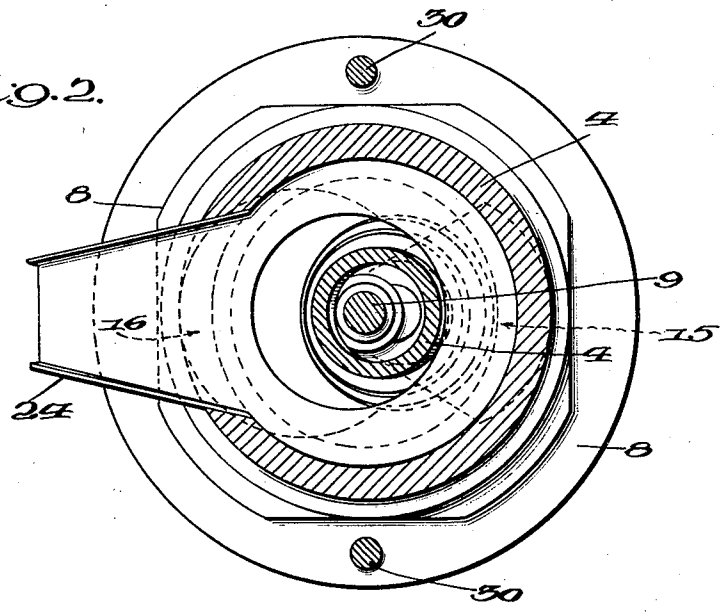
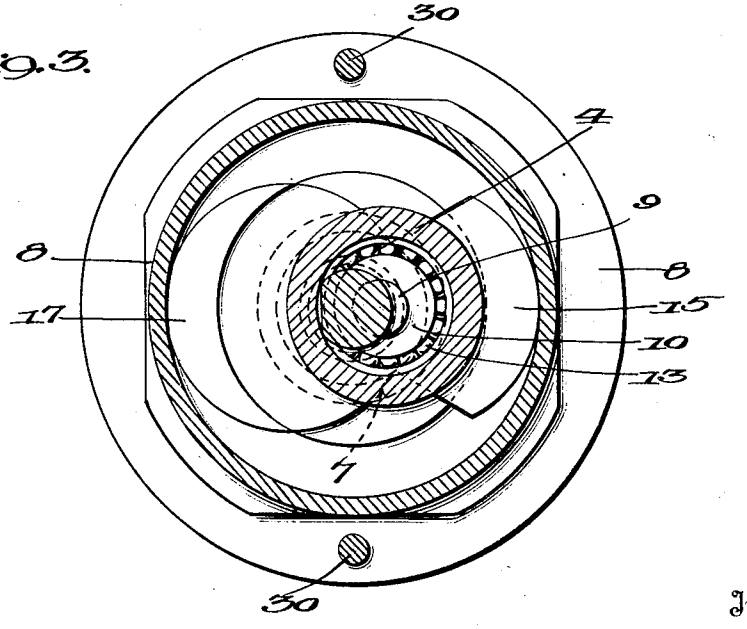


Fig. 3.



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DEVICE FOR CRUSHING AND PULVERIZING ORE AND OTHER REFRACTORY MATERIAL

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Fig. 4.

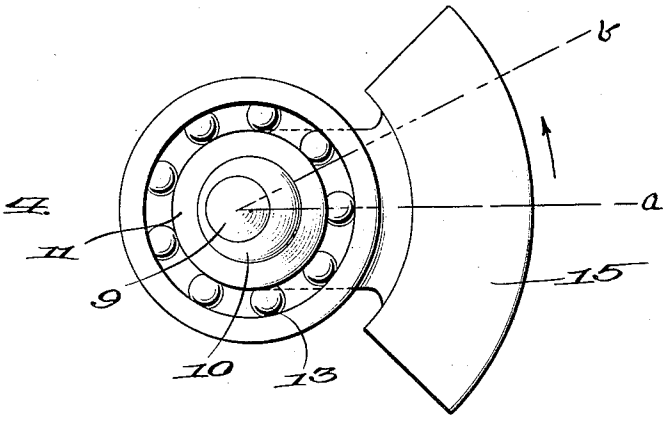


Fig. 5.

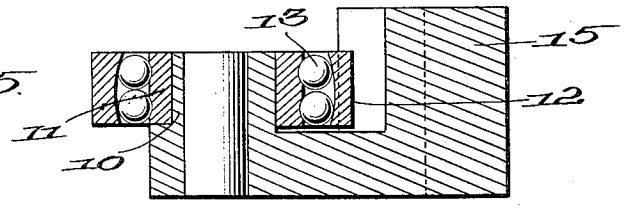
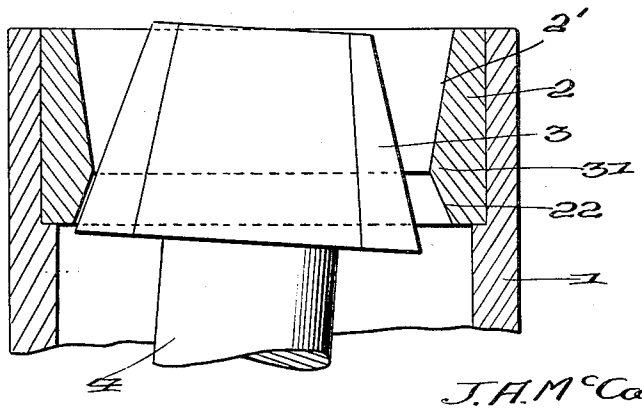


Fig. 6.



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DEVICE FOR CRUSHING AND PULVERIZING ORE AND OTHER REFRACTORY MATERIAL

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Fig. 7.

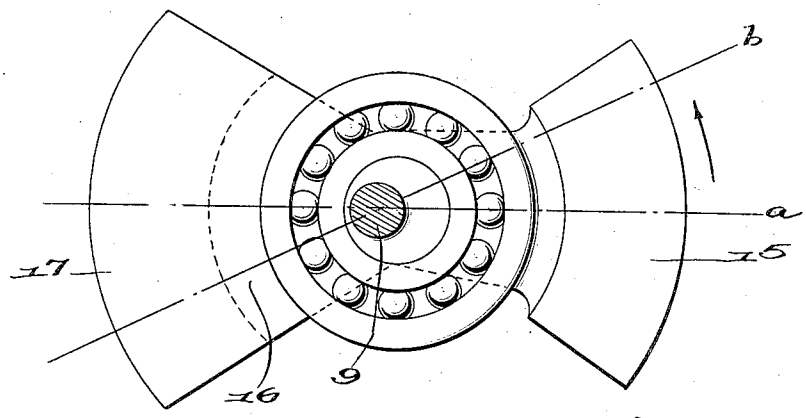


Fig. 8.

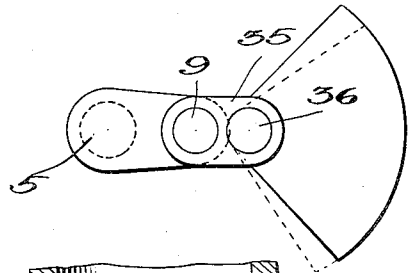
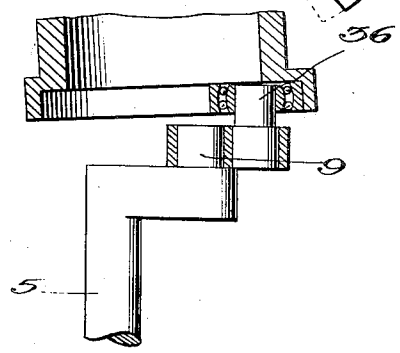


Fig. 9.



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Patented Nov. 28, 1933

1,936,728

UNITED STATES PATENT OFFICE

1,936,728

DEVICE FOR CRUSHING AND PULVERIZING ORE AND OTHER REFRACTORY MATERIAL

Jasper A. McCaskell, Salt Lake City, Utah, assignor to Utah Royalty Corporation, Salt Lake City, Utah, a corporation of Utah

Application May 12, 1931. Serial No. 536,847

16 Claims. (Cl. 83—10)

My invention relates to devices for crushing and pulverizing ore and other refractory material and relates particularly to the well known type of gyrating crushers in which a frustro-conical crusher element carried by a freely rotatable shaft is oscillated within a stationary hollow crushing member so as to crush and comminute material introduced between the outer face of the inner crushing member and the inner face of the stationary member.

I am aware that in gyrating crushers of this type the lower end of the shaft carrying the inner crusher member has been carried in a bearing sleeve within an eccentric sleeve which is positively rotated, but such construction involves the use of a heavy eccentric of metal subject to rapid wearing out and not adapted for high speed operation.

It is the subject of my invention to provide a crusher of this general type in which by use of a free floating eccentric wear will be reduced and the crusher will be adapted for use at any speed up to 1800 R. P. M., or higher, by which centrifugal force will be utilized as the crushing means; by which a cushioning effect upon the material to be crushed will be secured; by which greater crushing effect than is possible in other types of crusher will be produced; by which stalling or rupturing of the crushing members will be prevented; by which springs or other resilient means between the crushing members will be avoided; and by which larger capacity and finer crushing may be secured with less horse power than is required in crushers of known types.

With these and other objects hereinafter explained in view my invention consists and comprises the construction and combination of elements hereinafter described and claimed.

Referring to the drawings:

Figure 1 is a central vertical sectional view of a crusher embodying my invention.

Figure 2 is a cross sectional view on line 2—2 of Figure 1.

Figure 3 is a cross sectional view on line 3—3 of Figure 1.

Figure 4 is a detail plan view of the floating eccentric.

Figure 5 is a central vertical sectional view of the floating eccentric shown in Figure 4.

Figure 6 is a vertical central sectional view of the inner and outer crusher members.

Figure 7 is a top plan view of the floating eccentric and counterweight.

Figure 8 is a top plan view of a modified construction in which a loose link is substituted for the floating eccentric.

Figure 9 is a central vertical sectional view on line 9—9 of Figure 8.

In the drawings 1 indicates a tubular casing carrying within its upper end the hollow stationary crusher member 2. The cooperating crusher member 3 is carried by a hollow shaft 4 provided with an enlarged portion 4^1 at its upper end to receive the crusher member. Through the hollow shaft 4 extends a drive shaft 5 to the upper end of which is connected a suitable power device here shown as an electric motor 6. At its lower end this drive shaft is carried in a bearing 7 in the base 8. In the drive shaft 5 above the bearing 7 is formed a crank pin 9 on which is mounted a floating eccentric bushing 10 which is arranged within a ring 11 which is received in a recess 12 in the lower end of the hollow shaft 4. Ball bearing 13 is preferably provided between eccentric bushing 10 and ring 11. Rotation of drive shaft 5 through crank pin 9 and eccentric bushing 10 will cause the lower end of hollow shaft 4 and crusher member 3 carried by it to rock or swing within stationary crusher member 2.

Eccentric bushing 10 carries below the portion enclosing crank pin 9 a radially extending arm 14 at the outer end of which is a weight 15, and below this radially extending arm 14, between it and the bushing 7, drive shaft 5 carries rigidly connected to it a radially extending arm 16 at the outer end of which is a counterweight 17.

At its upper end the inner crusher member 3 with hollow shaft 4 is suspended from a thrust bearing comprising a ring 18 carried by, but loose, on neck 19 of inner crusher member and having its outer face from its upper edge to its lower edge formed on the arc of a circle of which the center is on the axial line of this crusher member. This convex outer surface of ring 18 bears against the balls of ball bearing 20 which is carried in a recess in the upper face of the top plate 21. Above ring 18 a nut 22 is screw-threaded onto the upper end of neck 19. By screwing this nut up or down the crusher member 3 with its hollow shaft 4 may be adjusted vertically to bring its crushing surface into desired relation to the inner surface of crusher member 2.

The top plate 21 is provided with suitable openings 23 through which the ore or other material may be fed to the space between the crusher members. Extending across the interior of the hollow shaft is a delivery plate 24 which extends through an opening 25 in casing 1 to receive the commi-

nuted material from the crusher members and deliver it outside into a suitable receptacle. The top plate 21 is secured to the base 8 which is adapted to receive within it the lower end of casing 1, by rods 30.

The hollow stationary crusher member flares outward and upward from a plane 31 forming upper face 2^1 and flares downward and outward from this plane to form lower face or skirt 2^2. The inner crusher member is frusto-conical with the end of less diameter upward. The inner crusher member is preferably in the form of a removable mantle or lining of suitable material suitably corrugated and the stationary crusher member which is itself removably arranged in the upper end of casing 1, may be provided with a mantle or bearing also removable.

It will be understood that the ore or other material to be crushed will be fed through the openings 23 of the top plate and will fall into the space between the upper portion of the face of the inner crusher member and the upper face 2^1 of the stationary crusher member.

The rotation of drive shaft 5 through its crank pin 9 causes eccentric bushing 10 to oscillate hollow shaft 4 and to cause crusher member 3 to gyrate within crusher member 2. The resistance of the material to be crushed will cause the eccentric bushing 10 to be carried around with the crank pin and will carry with it weight 15, this weight by its inertia tending at first to check rotation of the eccentric bushing and, when its speed of rotation is increased by the centrifugal force developed at high speed, will cause the eccentric bushing to impart an increased degree of oscillation to the hollow shaft. But, as the eccentric bushing is floating, the oscillation imparted to the hollow shaft will be yielding.

By reason of this yielding movement of oscillation controlled by centrifugal force arising from rotation of the eccentric bushing with its weight 15, the crushing members will effect the crushing of material introduced between them more completely and more rapidly than if the hollow shaft carrying the inner crushing member was carried at its lower end in an eccentric bearing in which the eccentric bushing is locked against rotation. The effect thus produced is in the nature of a cushioning effect permitting the inner crusher member to yield momentarily when material of unusual resistance is between the crushing members but this momentary yielding will, through the centrifugal force of the rotating weight, be succeeded by increased crushing action.

The weighted eccentric as shown in Figure 7 is so constructed that the median line of the eccentric always makes an angle with the line drawn through the centre of gravity of the eccentric bushing, whether the eccentric is in operation or at rest. In making the eccentric the weight line is first marked off on the bushing, then the eccentric is laid off for any desired angle with the weight line and machined on those centres. The weight line may either lead or lag behind the median line if so desired, the important factor is that there is always an angle between these lines. When the eccentric is in operation it always tries to maintain its centre of gravity line in line with a line drawn through the crank shaft and crank pin centres, this being the case, the median line of the eccentric is always held off the dead centre line between the crank shaft and crank pin centres.

It is, of course, to be understood that the hollow shaft 4 with its crusher member 3, while free to rotate, is not positively driven. The suspension or thrust bearing at its upper end and the ball bearing 13 at its lower end permit the hollow shaft to rotate freely so that the inner crusher member 3 may roll with reference to the outer crusher member as it acts upon the material to be crushed between its surface and the inner face of the stationary crusher member.

In Figures 8 and 9 I have shown a construction in which instead of the floating eccentric bushing 10, a link 35 is used. This link is loose on crank pin 9 and carries in its free end a pin 36 which is arranged to oscillate the hollow shaft 4. This construction is particularly adapted for application from below the base 8, the shaft 5 extending upward through the base. The floating eccentric construction may be, however, used with the drive shaft extending upward from below base 8.

The angle of the lower face of skirt 2^2 of the stationary crusher member is such with reference to the conical surface of the inner crusher member 3 that as the inner member gyrates the lower portion of its surface will be in close contact with this lower face 2^2 when the inner crusher member is in its maximum throw. The material to be treated introduced through opening 23 will be crushed between the upper face 2^1 of the outer crusher member and the face of the inner crusher member 3 gradually dropping to the plane indicated at 31, its dropping by gravity being retarded by the rapidly succeeding impacts upon it of the inner crusher member. As the material drops below this plane the close contact of the surface of the inner crusher member with the face 2^2 will effect a pulverization of the material, the fineness depending upon the length of the face or skirt 2^2 and the speed of the gyrations of the inner member.

It should be understood that I do not desire to be limited to the particular construction shown and described as it is obvious that changes in details of construction may be made without departing from the spirit of my invention. For instance, it is obvious that the floating eccentric may be used in connection with the movable jaw of a jaw crusher in which the movable jaw is given a reciprocating movement instead of the gyrating movement given to the hollow shaft 4 of this application.

Having thus described my invention, what I claim is:

1. In a crusher having a stationary crusher member and a movable crusher member cooperating therewith, means for moving the movable crusher member to and from the stationary crusher member comprising a crank pin and a floating eccentric carried by the crank pin, freely rotatable around the crank pin and cooperating with the movable crusher member.

2. In a gyratory crusher, a tubular casing, a base adapted to receive the lower end of the casing, a top plate adapted to engage the upper end of the casing, rods connecting the top plate and the base, an outer crusher member in the upper end of the casing, a hollow shaft extending downward into the casing having in the top plate a bearing adapted to permit said hollow shaft to swing, a drive shaft extending through the hollow shaft having at its lower end a bearing in said base, and having a crank pin above its lower end, an eccentric bushing carried by said crank pin, and a bearing ring for the eccentric bushing in the lower end of the hollow shaft.

3. In a gyratory crusher, a tubular casing, a base adapted to receive the lower end of the

casing, a top plate adapted to engage the upper end of the casing, rods connecting the top plate and the base, an outer crusher member in the upper end of the casing, a hollow shaft extending downward into the casing having in the top plate a bearing adapted to permit said hollow shaft to swing, a drive shaft extending through the hollow shaft having at its lower end a bearing in said base, and having a crank pin above its lower end, an eccentric bushing carried by said crank pin, a bearing ring for the eccentric bushing in the lower end of the hollow shaft, said eccentric bushing having an arm extending radially therefrom having a weight at its outer end.

4. In a gyratory crusher, a tubular casing, a base adapted to receive the lower end of the casing, a top plate adapted to engage the upper end of the casing, rods connecting the top plate and the base, an outer crusher member in the upper end of the casing, a hollow shaft extending downward into the casing having in the top plate a bearing adapted to permit said hollow shaft to swing, a drive shaft extending through the hollow shaft having at its lower end a bearing in said base, and having a crank pin above its lower end, an eccentric bushing carried by said crank pin, a bearing ring for the eccentric bushing in the lower end of the hollow shaft, said eccentric bushing having an arm extending radially therefrom having a weight at its outer end and an arm carried by the drive shaft extending radially therefrom carrying a weight at its end.

5. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a shaft carrying said inner crushing member and means for oscillating said shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin freely rotatable around the crank pin and in operative relation with said shaft carrying the inner crushing member.

6. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a shaft carrying said inner crushing member and means for oscillating said shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm, a floating eccentric carried by the crank pin and in operative relation with said shaft carrying the inner crushing member and a weighted arm carried by and extending radially from said floating eccentric.

7. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a shaft carrying said inner crushing member and means for oscillating said shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin freely rotatable around the crank pin and in operative relation with one end of said shaft carrying the inner crushing member.

8. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a hollow shaft carrying said inner crushing member and means for oscillating said hollow shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin freely rotatable around the crank pin within one end of said hollow shaft and in operative relation therewith.

9. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a hollow shaft carrying said inner crushing member, and means for oscillating said hollow shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin freely rotatable around the crank pin and in operative relation with said hollow shaft.

10. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a hollow shaft carrying said inner crushing member, and means for oscillating said hollow shaft comprising a drive shaft extending into said hollow shaft, a crank arm on the drive shaft, a crank pin carried by the crank arm and an eccentric bushing carried by the crank pin freely rotatable thereon the bushing engaging the hollow shaft and in operative relation with said hollow shaft.

11. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a hollow shaft carrying said inner crushing member, and means for oscillating said hollow shaft comprising a drive shaft extending into said hollow shaft, a crank arm on the drive shaft, a crank pin carried by the crank arm, an eccentric bushing carried by the crank pin freely rotatable thereon the bushing engaging the interior of the hollow shaft, and in operative relation with said hollow shaft, and an arm extending radially from the eccentric bushing having a weight at its end.

12. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a hollow shaft carrying said inner crushing member and having a circular recess in its lower end, and means for oscillating said hollow shaft comprising a drive shaft extending into said hollow shaft having a crank arm thereon, a crank pin carried by the crank arm and an eccentric bushing carried by the crank pin and freely rotatable thereon, and in operative relation with said hollow shaft arranged within said recess.

13. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a shaft carrying said inner crushing member, and means for oscillating said shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin and in operative relation with said shaft carrying the inner crusher member, and means carried by the crank arm for balancing said floating eccentric.

14. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a shaft carryng said inner crushing member, and means for oscillating said shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin and in operative relation with said shaft carrying the inner crusher member, a weighted arm carried by the floating eccentric and means carried by the crank arm for balancing said weighted arm comprising a weighted arm carried by the crank arm.

15. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a hollow shaft carrying said inner crushing member, means for oscillating said hollow shaft comprising a

drive shaft extending into said hollow shaft bearing, a crank pin thereon, an eccentric bushing carried by the crank pin, freely rotatable thereon and in operative relation with said shaft carrying the inner crushing member, a weighted arm carried by the eccentric bushing extending radially therefrom and means carried by the drive shaft for balancing said weighted arm carried by the eccentric bushing.

16. In a gyratory crusher having an outer hollow member and an inner crushing member adapted to cooperate therewith, a shaft carrying said inner crushing member, and means for oscillating said shaft comprising a crank arm and means for rotating it, a crank pin carried by the crank arm and a floating eccentric carried by the crank pin and in operative relation with said shaft carrying the inner crusher member, a weighted arm carried by and extending radially from the floating eccentric so constructed that its median line is normally at an angle to a line drawn through the centre gravity of the floating eccentric.

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