

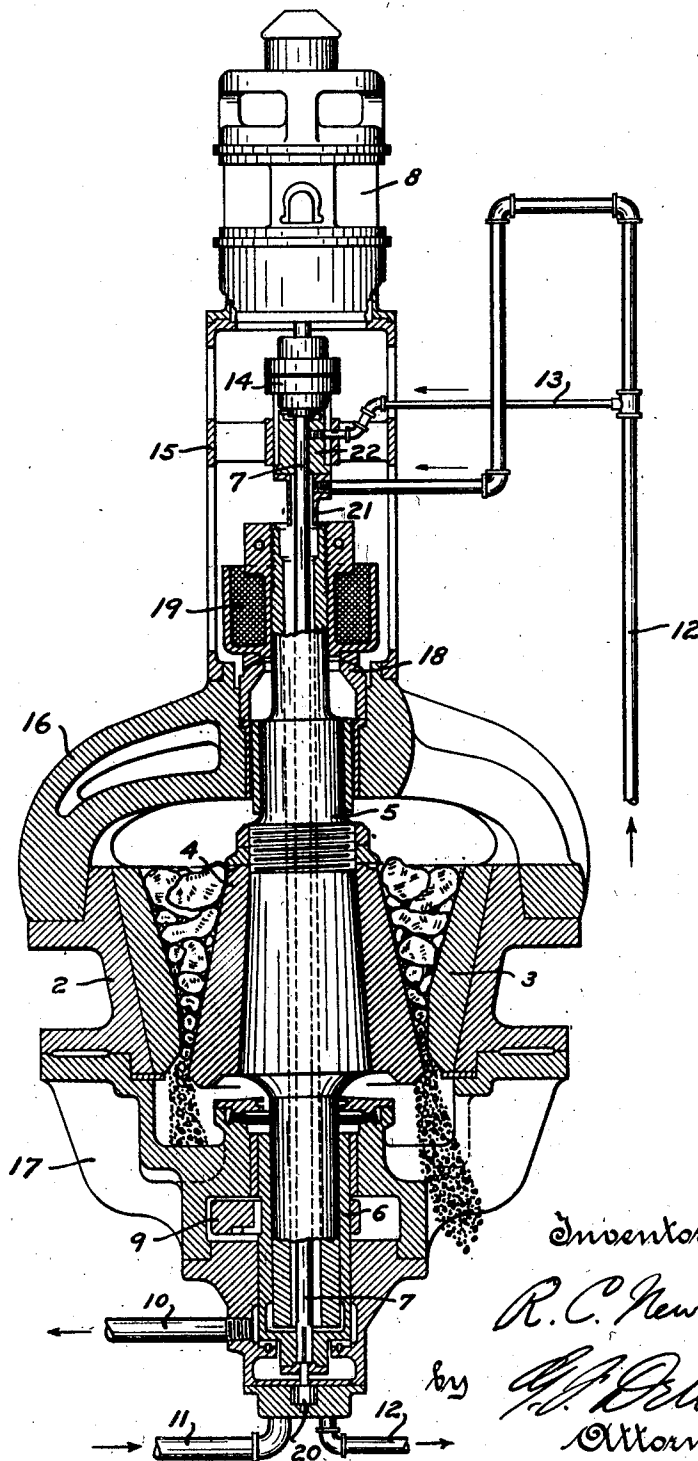
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CRUSHER.

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CRUSHER

Application filed September 15, 1922, Serial No. 588,401. Renewed December 22, 1927.

This invention relates in general to improvements in the art of reducing materials, and relates more specifically to improvements in the construction and operation of crushers for reducing substances such as rock, coal and the like.

An object of the invention is to provide a crusher which is simple in construction and efficient in operation.

Some of the more specific objects of the invention are as follows:

To provide a simple and compact crusher of relatively large capacity.

To provide an efficient gyratory crusher operable at high speed.

To provide an improved direct drive for a gyratory crusher.

To provide simple and efficient means for eliminating vibration in a crusher operated at relatively high speed.

To provide a crusher in which the various parts are readily accessible and in which the relatively frail mechanism is protected against damage.

To provide simple and efficient means for maintaining proper lubrication of the working elements of a crusher.

To provide other improved details of crusher construction, which will enhance to a maximum the efficiency of operation and which will reduce to a minimum the cost of construction and of maintenance.

Subject matter relating to the high speed crusher and method, and at one time claimed herein, is claimed in applicant's copending application Ser. No. 757,309, filed December 22, 1924.

A clear conception of an embodiment of the invention and of the operation of a device constructed in accordance therewith, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts of the mechanism.

The single figure of the drawing illustrates a central vertical section through a direct-connected motor-driven gyratory crusher.

The gyratory crusher comprises generally a stationary annular crushing element or concave 3 and a movable crushing element

or head 4 located within the concave 3, the head 4 being gyratable relatively to the concave. The concave 3 is supported in a stationary frame 2 while the head 4 is rigidly attached to a vertical suspension member or hollow shaft 5. The upper extremity of the hollow shaft 5 is provided with a spherical suspension bearing 18 carried by means of a spider 16 from the stationary frame 2. The lower extremity of the hollow shaft 5, directly below the head 4, is provided with a cylindrical portion which fits within the bore of a gyrating device or eccentric 6. The outer surface of the eccentric 6 coacts with bearings in the lower frame 17 which is rigidly attached to the stationary frame 2.

Suitable driving means such as an electric motor 8 is mounted upon a support 15 carried by the spider 16. The rotor of the motor 8 is direct connected to a drive shaft 7 through a flexible coupling 14, the lower end of the drive shaft 7 being keyed or otherwise rigidly attached to the eccentric 6. With this arrangement of elements it will be noted that the shaft 7 and coupling 14 provide a direct mechanical connection between the driving motor 8 and the eccentric 6, the direct driving connection passing through but being spaced from the interior of the hollow shaft 5. The drive shaft 7 may be provided with a bearing 22 in the support 15 adjacent to the motor, and is disposed concentric relatively to the concave 3.

The driving eccentric 6 is preferably provided with a balance weight 9 secured to the medial portion of the eccentric by means of a key, as shown. The balance weight 9 comprises a mass of metal having a bore which snugly fits the exterior cylindrical surface of the eccentric 6, the center of gravity of the weight 9 being disposed at the side of the axis of the eccentric remote from the axis of the eccentric bore. The hollow shaft 5 which is suspended by means of a spherical suspension bearing 18, and the axis of which intersects the axis of the crusher below the spherical surface of the bearing 18, may also be provided with a counter-balance weight 19 located above the suspension bearing 18. The weight 19 is formed of a cup

shaped casting which is filled with lead or other relatively heavy metal. The weight 19 as shown, is cylindrical in shape and is mounted concentric with the inclined shaft 5, the center of gravity of the weight 19 being located on the same side of the vertical axis of the crusher as the center of gravity of the weight 9. It will thus be noted that the centers of gravity of both the weight 9 and of the weight 19 are on one side of the vertical axis of the machine while the center of gravity of the crushing head 4 and shaft 5 is on the opposite side of the vertical axis of the machine. Other counter-balancing means may be provided, and the balance weights 9, 19 are preferably made adjustable in position in order to secure a perfect counter-balance of the weight of the head 4 and shaft 5 by means of the balancing weights 9, 19.

The lower extremity of the eccentric 6 is operatively connected to the rotor of a gear pump 20 which is adapted to force oil through the pipe 12 and through the branch pipe 13, to the upper portion of the crusher. The pipe 13 leads directly to the bearing 22 and the pipe 12 leads to an oil nozzle attached to the lower portion of the bearing 22 and directed downwardly through the hollow shaft 5. A pipe 10 leading from the exterior of the lower portion of the eccentric 6 communicates with an ordinary oil cooler which in turn communicates with the suction side of the pump 20 through a suitable pipe 11.

During normal operation of the crusher the motor 8 is being operated to rotate the eccentric 6 at high speed by virtue of the direct connecting drive shaft 7. As the eccentric 6 rotates, the hollow shaft 5 and the crushing head 4 are gyrated within the concave 3. The material admitted downwardly to the space between the head 4 and concave 3 is reduced by virtue of the relative gyration of the crusher elements and is eventually discharged through the annular space between the lower portions of the head 4 and the concave 3. Due to the high speed of operation and also due to the fact that the head 4 and shaft 5 are of considerable mass, it is necessary in order to eliminate vibration of the supporting structures, to provide balancing means such as the counterbalancing weights 9, 19.

While the crusher is in operation, the pump 20 is acting to produce a continuous circulation of oil through the pipes 12, 13 to the bearing 22 and to the interior of the eccentric 6 through the hollow shaft 5. The oil admitted to the interior of the eccentric 6 passes upwardly along the bearing surfaces between the eccentric and the shaft 5 to the chamber above the eccentric. By virtue of the seal provided between the shaft 6 and the adjacent stationary frame directly below the head 4, the oil admitted to the chamber above

the eccentric is forced to pass downwardly along the outer bearing surface of the eccentric until the thrust bearing at the lower extremity of the eccentric 6 is reached. After reaching this thrust bearing the oil flows through the pipe 10 to the cooler and from the cooler back to the pump 20 through the pump inlet pipe 11.

It will be noted that by operating the crusher at the speed of the motor 8, a relatively small crusher of enormous capacity is produced. The direct drive from the motor 8 to the eccentric 6 simplifies the construction as compared to prior crushers of this type employing speed reducing gearing between the eccentric and the driving motor. The eccentric 6 is completely enclosed and is thereby protected against the admission of gritty substances. The motor 8 may be located at some distance above the crushing chamber being thus protected against injury due to the entrance of gritty substances. All parts of the crusher are readily accessible for inspection and adjustment and the operation of the device is entirely automatic.

It should be understood that it is not desired to limit the invention to the exact details of construction and of operation herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In combination, a crusher comprising relatively gyratable crushing elements having adjacent feed and discharge ends, a rotary member for relatively gyrating said elements, said member being located at one of said ends of said elements, driving means located at the other of said ends of said elements, and a rotary motion transmitting connection positively connecting said driving means and said member.

2. In combination, a crusher comprising relatively gyratable crusher elements, a rotary eccentric for relatively gyrating said elements, said eccentric being located below said elements, means located above said elements for rotating said eccentric to produce relative gyration of said elements, and a direct mechanical connection between said eccentric and said eccentric rotating means, said connection extending downwardly through one of said elements.

3. In combination, a crusher comprising concaves and a head gyratable within said concaves, an eccentric for gyrating said head, said eccentric being located below and closely adjacent to said head, a motor located above said head for rotating said eccentric to gyrate said head, and a direct mechanical connection between said motor and said eccentric extending downwardly through said head.

4. In combination, a crusher comprising

concaves and a head gyratable within said concaves, a rotary member for gyrating said head, said member being located below and closely adjacent to said head, a high speed motor located above said head for rapidly rotating said member to positively gyrate said head, and a direct mechanical connection between said motor and said member.

5. In combination, a crusher comprising a stationary element and a movable element, a hollow member supporting said movable element, bearings for said member located on opposite sides of said movable element, means associated with one of said bearings for moving said movable element relatively to said stationary element, and driving means for said moving means extending through said hollow member.

6. In combination, a crusher head, means for suspending said head from above, and means for positively gyrating said head with a fixed radius of gyration, said gyrating means comprising an element extending downwardly into said head and functioning independently of said suspension means.

7. In combination, a crusher head, hollow suspension means for said head located thereabove, means comprising an eccentric for positively gyrating said head, and a driving element for said eccentric extending downwardly through and functioning independently of said suspension means.

8. In combination, a crusher head, hollow suspension means for said head located thereabove, and means including an eccentric and a shaft for rotating said eccentric extending through said suspension means, said shaft functioning independently of said suspension means.

9. In combination, a concave, a crusher head located within said concave, suspension means for said head located entirely above said concave, means for positively gyrating said head with a fixed radius of gyration, and driving means for said gyrating means comprising an element extending downwardly into said head and functioning independently of said suspension means.

10. In combination, a concave, a hollow crusher head located within said concave, universal suspension means for said head located above said concave, and means comprising a driving shaft extending through said suspension means for positively gyrating said head with a fixed radius of gyration, said driving shaft functioning independently of said suspension means.

11. In combination, a concave, a hollow crusher head located within said concave, universal suspension means for said head located above said concave, an eccentric located below said head, and a driving shaft for said eccentric extending through said suspension means, said driving shaft functioning independently of said suspension means.

12. In combination, a crusher comprising concaves and a hollow head gyratable within said concaves, rotatable means located below and closely adjacent to said head for positively imparting gyratory movement thereto, a source of power located above said head, and a direct mechanical connection between said power source and said eccentric extending downwardly through said head.

13. In combination, a crusher comprising concaves and a head gyratable within said concaves, an eccentric coacting with said head, said eccentric being located below said head, a high speed motor located above said head, and a direct mechanical connection between said motor and said eccentric.

14. In combination, a crusher comprising concaves and a head gyratable within said concaves, an eccentric coacting with said head, said eccentric being located below said head, a high speed motor located above said head, and a direct mechanical connection between said motor and said eccentric passing centrally through said head.

15. In combination, a crusher comprising concaves and a head gyratable within said concaves, a hollow shaft for supporting said head, an eccentric cooperating with said shaft to gyrate said head, said eccentric being located below and closely adjacent to said head, a high speed motor located above said head, and a direct mechanical connection between said motor and said eccentric passing downwardly through said hollow shaft.

16. In a crusher, inner and outer crushing members cooperating to form a crushing chamber, means for relatively gyrating said members, and weights associated with said members on opposite sides of said chamber for counterbalancing the unbalanced forces set up in said members due to said gyration.

17. In combination, a crusher comprising concaves and a head gyratable within said concaves, a rotary eccentric for positively gyrating said head, said eccentric being located below said head, a weight associated and revolving with said eccentric for counterbalancing the unbalanced forces set up in said head and said eccentric, a high speed motor located above said head, and a direct mechanical connection between said motor and said eccentric.

18. In combination, a crusher comprising concaves and a head gyratable within said concaves, a rotary eccentric for positively gyrating said head, balancing means for eliminating vibration, said means comprising a balance weight associated and revolving with said eccentric for counterbalancing the unbalanced forces set up in said head and said eccentric, a high speed motor, and a direct mechanical connection between said motor and said eccentric.

19. In a crusher, relatively gyratable crushing members between which material

advances by gravity, a rotary eccentric for positively relatively gyrating said members at a high rate of speed, and balancing means for eliminating vibration, said means comprising a balance weight associated and revolving with said eccentric for counterbalancing the unbalanced forces set up in said members due to said gyration.

20. In a crusher, relatively gyratable crushing members between which material advances by gravity, means for positively relatively gyrating said members at a high rate of speed, and balancing means for eliminating vibration, said means comprising a balance weight for counterbalancing the unbalanced forces set up in said members due to said gyration.

21. In a crusher, relatively gyratable crushing members between which material advances by gravity, a rotary eccentric for positively relatively gyrating said members at a high rate of speed, and a weight associated and revolving with said eccentric for counterbalancing the unbalanced forces set up in said members due to said gyration, said eccentric being endwise removable from association with said weight.

22. In a crusher, relatively gyratable inner and outer crushing members, a rotary eccentric for positively gyrating said inner crushing member, said eccentric comprising a member having a circular outer bearing surface and an eccentric bore extending longitudinally of said member within said surface, and a counterbalance weight secured to said eccentric and disposed eccentrically thereof on the side of the axis of said bearing surface opposite to the axis of said bore.

23. In combination, a crusher comprising concave and a head gyratable within said concaves, a rotary eccentric disposed closely adjacent to said head for positively gyrating the same, said eccentric comprising a member having a circular outer bearing surface and an eccentric bore extending longitudinally of said member within said surface, and a counterbalance weight secured to said eccentric and disposed eccentrically thereof on the side of the axis of said surface remote from the axis of said bore.

24. In combination, a crusher comprising concaves and a head gyratable within said concaves, a rotary eccentric for positively gyrating said head, and balancing means for eliminating vibration, said means comprising a balance weight associated and revolving with said eccentric for counterbalancing the unbalanced forces set up in said head and said eccentric.

25. In a crusher, relatively gyratable crushing members located one within the other and having a crushing chamber between them, a rotary eccentric for positively relatively gyrating said members, and balancing means for eliminating vibration, said means

comprising a balance weight associated and revolving with said eccentric for counterbalancing the unbalanced forces set up in said members due to said gyration.

26. In a crusher, relatively gyratable crushing members located one within the other and having a crushing chamber between them, movable means for positively relatively gyrating said members, and balancing means for eliminating vibration, said means comprising a balance weight associated and moving with said means for counterbalancing the unbalanced forces set up in said members due to the gyration thereof.

27. In a crusher, the combination of a stationary crushing member, a gyratory crushing member, said members having axes intersecting at a fulcrum point and forming a crushing chamber between them at one side only of said fulcrum point, and balancing means for eliminating vibration, said means comprising a counterbalance weight on said gyratory member on the other side of said fulcrum point.

28. In combination, a crusher comprising relatively gyratable crushing elements having adjacent feed and discharge ends, a rotary eccentric coacting with one of said elements, said eccentric being located at the discharge ends of said elements, driving means located at the feed ends of said elements, and a rotary motion transmitting connection positively connecting said driving means and said eccentric.

29. In combination, a crusher comprising relatively gyratable crushing elements, a rotary member coacting with one of said elements, said member being located below said elements, means located above said elements for rotating said member at high speed to produce rapid and positive relative gyration of said elements, and a direct mechanical connection between said member and said rotating means, said connection extending downwardly through one of said elements.

In testimony whereof, the signature of the inventor is affixed hereto.

RAY C. NEWHOUSE.