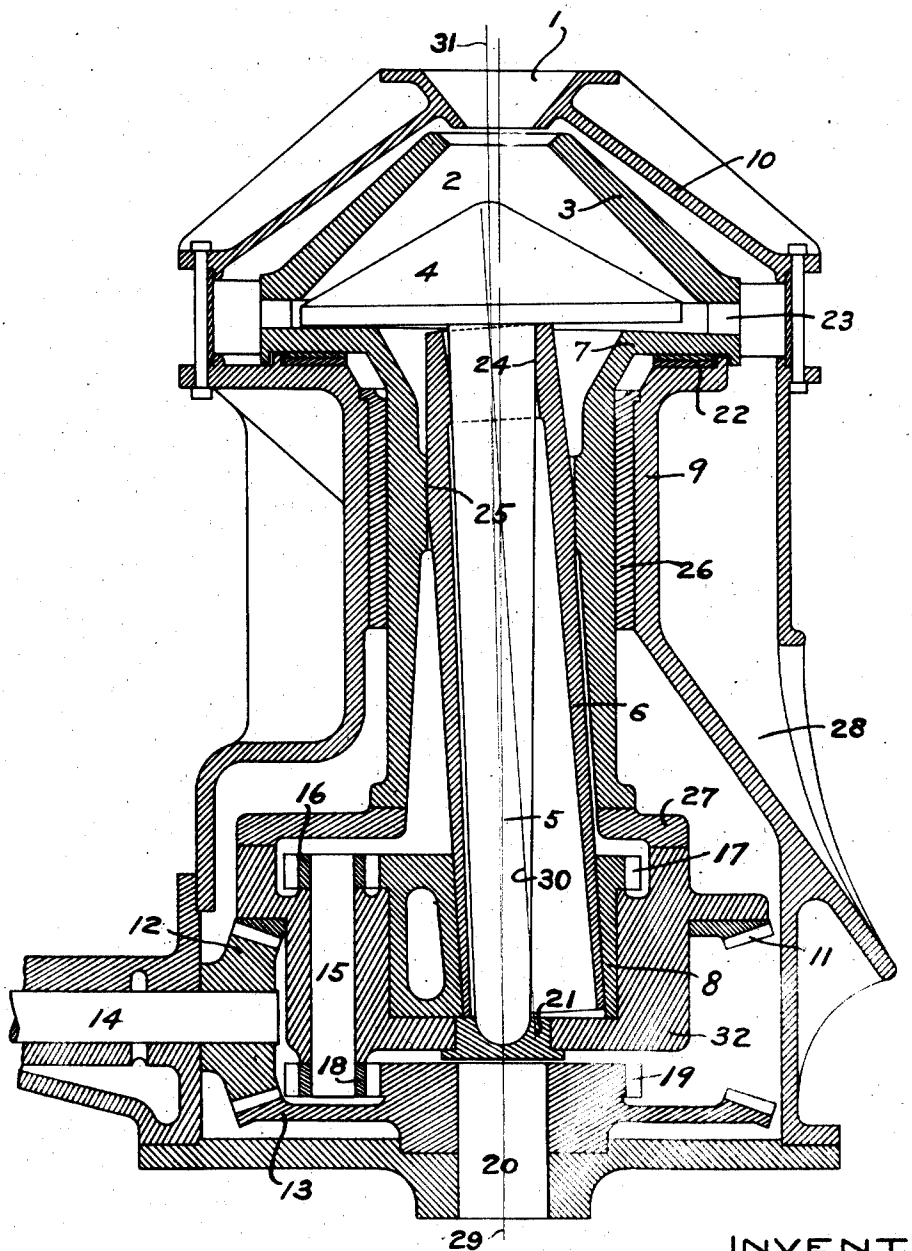
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CRUSHER

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CRUSHER.

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This invention relates in general to improvements in the construction and operation of crushing machines, and is more especially applicable to crushers of the gyratory type.

An object of the invention is to provide an improved crusher which is simple in construction and efficient in operation. Another object of the invention is to provide a gyratory crusher having relatively great crushing capacity. A further object of the invention is to provide a gyratory crusher which is capable of reducing relatively hard substances. Still another object of the invention is to provide an extremely compact crusher structure wherein the reduced material may be delivered from the machine by centrifugal force acting thereon. A further object of the invention is to provide a compound lever structure wherein the bearing pressures are effectively distributed and friction losses are minimized. These and other objects and advantages of the present invention will appear from the following description.

A clear conception of an embodiment of the invention and of the operation of machines constructed in accordance therewith, may be had by referring to the drawing accompanying and forming a part of this specification in which the various parts are referred to by suitable reference characters.

The single figure of the drawing is a somewhat diagrammatic central vertical section through a disk type of gyratory crusher embodying the improvement.

The crusher specifically illustrated in the drawing comprises in general concave and convex outer and inner crushing members 3, 4 respectively cooperating to form a downwardly flaring intervening crushing chamber 2, and simultaneously gyratable and movable toward and away from each other to crush material as it is urged through the chamber 2 by centrifugal force. The outer crushing member 3 is associated with or may be secured directly to a rotary support 7 journalled in a guide bearing sleeve 26 attached to the stationary frame 9, and is also supported upon a thrust bearing 22. The frame 9 also provides a support for a top casing 10 which in turn supports a material supply hopper 1 having a lower discharge opening directed into the central portion of the crushing chamber 2. The discharge end of the crushing chamber 2 communicates with an annular discharge opening 23 directed toward liner plates carried by the frame 9, below which the final crusher discharge opening 28 is located.

The rotary support 7 and the outer crushing member 3 associated therewith, are directly rotatable at relatively high speed by means of a power shaft 14 and a pinion 12, the latter of which meshes with a bevel gear 11 secured to the driving member 32 which is attached directly to the lower extremity of the support 7 by means of a connecting plate 27. The driving member 32 also constitutes a support for an eccentric 8 which is rotatable in a direction opposite to that of the support 7 and of the member 32, by means of gears 13, 16, 17, 18, 19 and a counter-shaft 15, as clearly indicated in the drawing. The gearing for driving the eccentric 8 may be so designed that the relative gyration is effected at a much higher speed than the direct rotation of the crushing members in the opposite direction. The bevel gear 13 may be supported by a bearing member 20 secured to a base plate which may be detachably associated with the stationary frame 9.

The interior of the tubular portion of the support 7 is provided with a bore 25 within which a gyratable lever or sleeve 6 is rollably disposed. The opposite sides of the tapered medial portion of the sleeve 6 have line contact with the cylindrical bore 25 and the lower end of the sleeve is eccentrically journalled within the eccentric 8 as shown. The upper portion of the sleeve 6 is provided with tapered bores 24 which are rollably engaged by the adjacent portion of a supporting lever or shaft 5. The inner crushing head 4 is rigidly attached to the upper extremity of the supporting shaft 5, and the lower extremity of this shaft is fulcrumed in a thrust bearing 21 secured to the member 32. It will be apparent that the lever shaft 5 is disposed concentric with an axis 31 which intersects the central axis 29 of the crusher at the thrust bearing 21, while the axis 30 of the lever sleeve 6 intersects the center line 31 of the shaft 5 and inner crushing member 4.

During normal operation of the crusher, power is applied through the shaft 14 and the gearing 11, 12 to rotate the outer crushing member 3 at relatively high speed. The

material admitted from the hopper 1 to the downwardly flaring chamber 2, is thrown outwardly through this crushing chamber and wedges between the members 3, 4 thereby producing simultaneous rotation of these members at substantially the same speed. The rotary motion of the shaft 14 is also transmitted through the gearing 13, 16, 17, 18, 19 to the eccentric 8 and causes this eccentric to revolve rapidly in a direction opposite to the direction of rotation of the crushing members. The revolving eccentric 8 causes the lever sleeve 6 to roll upon the bore 25 and about the axis 30, during simultaneous gyration of the sleeve 6 about the central crusher axis 29. As the inner crushing member 4 is prevented from rotating freely relatively to the outer crushing member 3, by the material wedged between these members, the lever shaft 5 which supports the inner member 4, will of necessity likewise roll upon the bore 24 at the outer end of the sleeve 6. The gyrating sleeve and shaft 5 constitute a compound lever which causes the member 4 to approach and recede from the member 3, by virtue of the relative gyration of these elements, thus crushing the material as it advances outwardly between the members 3, 4 until it is eventually delivered through the discharge opening 23 and the final discharge 28.

By virtue of the compound leverage afforded by the sleeve 6 and the shaft 5, the material within the crushing chamber 2 is subjected to the desired crushing pressure, while the bearings of the motion producing elements are not overburdened with pressure. The sleeve 6 serves as a lever with its fulcrum at the bore 25, for actuating the lever afforded by the shaft 5, and the fulcrum of the lever shaft 5 is the thrust bearing 21 while the power is applied thereto at the bore 24 of the sleeve 6. By causing the eccentric 8 to travel at a higher speed than in the opposite direction to the direction of rotation of the crushing members 2, 3, the material within the crushing chamber 2 is obviously subjected to several crushing impulses during each revolution of the crushing member 5, thereby producing maximum capacity of crushing.

It should be understood that it is not desired to limit the invention to the exact details of construction and 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 a crusher, a pair of crushing members cooperating to form a crushing chamber, and means for relatively gyrating said members, said means comprising a revolvable compound lever structure.

2. In a crusher, a pair of crushing members cooperating to form a crushing chamber, means for rotating said members to feed material through said crushing chamber, and means for relatively gyrating said members, said gyrating means comprising a rotary compound lever structure.

3. In a crusher, a pair of crushing members cooperating to form a crushing chamber, means for positively rotating one of said members, and a compound lever structure for gyrating the other of said members.

4. In a crusher, a pair of crushing members cooperating to form a crushing chamber, a rotary eccentric, and a compound lever structure operable by said eccentric to relatively gyrate said members.

5. In a crusher, a pair of crushing members cooperating to form a crushing chamber, means for rotating said members to feed material through said crushing chamber, a rotary eccentric, and a compound lever structure operable by said eccentric to relatively gyrate said members.

6. In a crusher, a pair of crushing members cooperating to form a crushing chamber, a rotary eccentric, a sleeve gyratable by said eccentric, and a shaft associated directly with one of said members and gyratable by said sleeve.

7. In a crusher, a pair of crushing members cooperating to form a crushing chamber, means for rotating said members to feed material through said crushing chamber, an eccentric, a sleeve gyratable by said eccentric, and a shaft associated directly with one of said members, said shaft being located within and gyratable by said sleeve.

8. In a crusher, a pair of crushing members cooperable to form a crushing chamber, a rotary eccentric, a hollow sleeve having a central axis intersecting the central axis of said crushing members, and a shaft secured directly to one of said members and having an axis intersecting the central crusher axis, said shaft being disposed within said sleeve and gyratable thereby.

9. In a crusher, a pair of crushing members, a support for one of said members having a bore, a sleeve rollable within the bore of said support, and a shaft associated with one of said crushing members, said shaft being rollable within the bore of said sleeve.

10. In a crusher, a pair of crushing members, a support for one of said members having a bore, means for simultaneously rotating said members and said support, a sleeve rollable within the bore of said support, and a shaft secured to one of said crushing members, said shaft being rollable within the bore of said sleeve.

11. In a crusher, a pair of crushing members cooperable to form a crushing chamber, a support for one of said members having a bore, means for simultaneously rotating said members and said support, a sleeve roll-

able within the bore of said support, an eccentric for gyrating said sleeve, and a shaft associated with one of said crushing members, said shaft being rollable within the bore of said sleeve.

12. In a crusher, a pair of crushing members cooperable to form a crushing chamber, a support for said members, means for rotating said support to simultaneously rotate said members, a sleeve rollable within the bore of said support, an eccentric for gyrating said sleeve, and a shaft secured to the other of said members and rollable within the bore of said sleeve.

13. In a crusher, a pair of crushing members cooperable to form a crushing chamber, means for rotating said members in one direction, and a compound lever structure for relatively gyrating said members in the opposite direction.

14. In a crusher, a pair of crushing members cooperable to form a crushing chamber, a rotary eccentric, a compound lever structure operable by said eccentric to relatively gyrate said members in one direction, and means for rotating said members in the opposite direction.

15. In a crusher, a pair of crushing members cooperable to form a crushing chamber, a support for said members, said support having a bore, means for rotating said members through said support in one direction, a sleeve rollable within the bore of said support, an eccentric for gyrating said sleeve in the opposite direction, and a shaft secured to one of said members and rollable within the bore of said sleeve.

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

CARL G. SPRADO.