July 19, 1932. E. B. SYMONS 1,868,338

CRUSHING APPARATUS

Original Filed Feb. 20, 1929 2 Sheets-Sheet 1

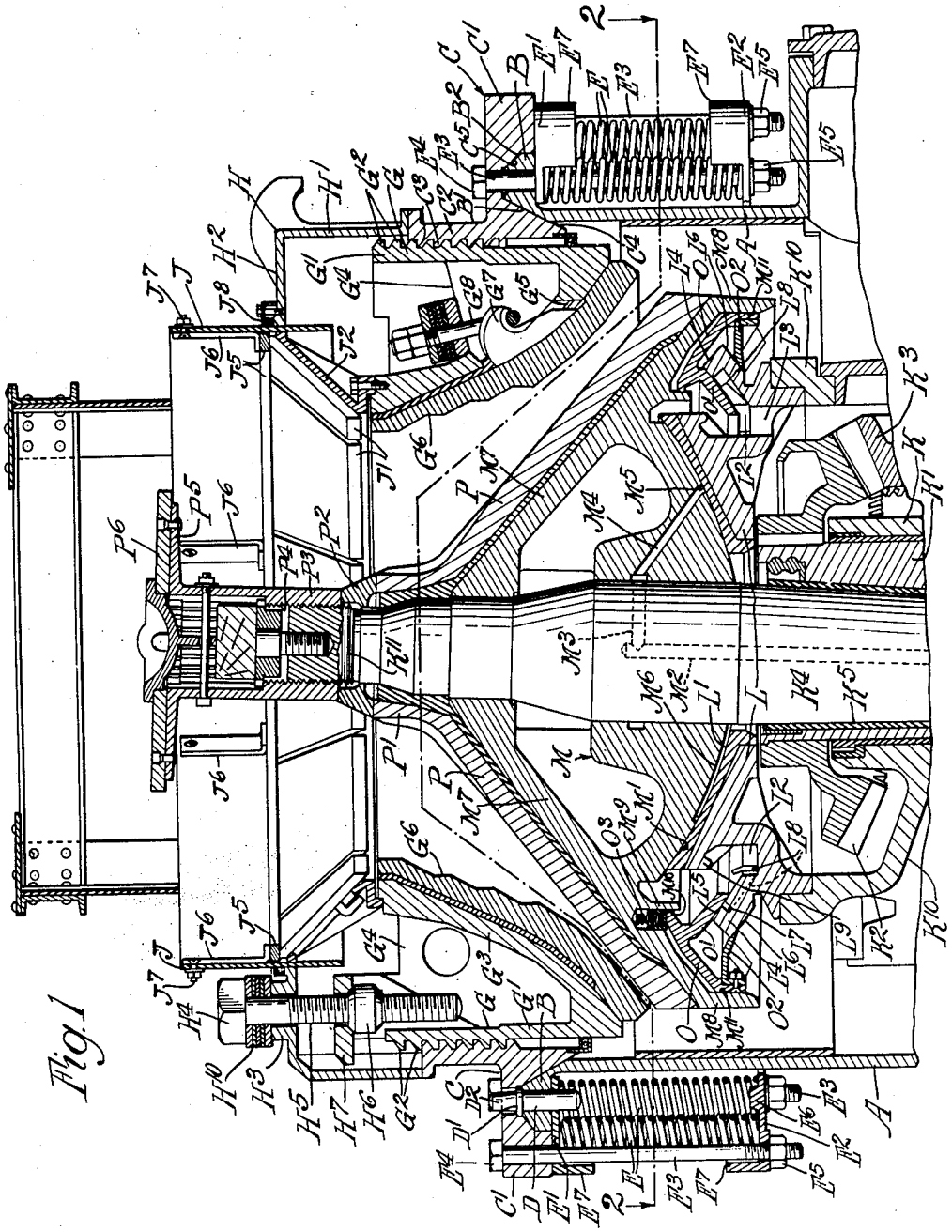


Fig. 1

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Fig. 3.

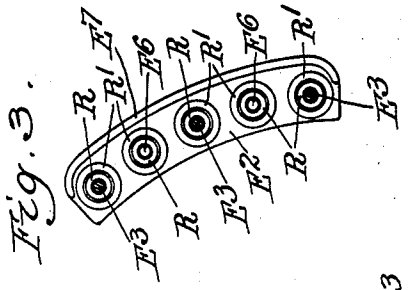


Fig. 4.

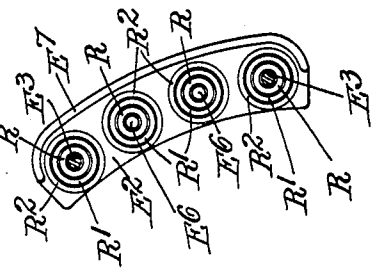
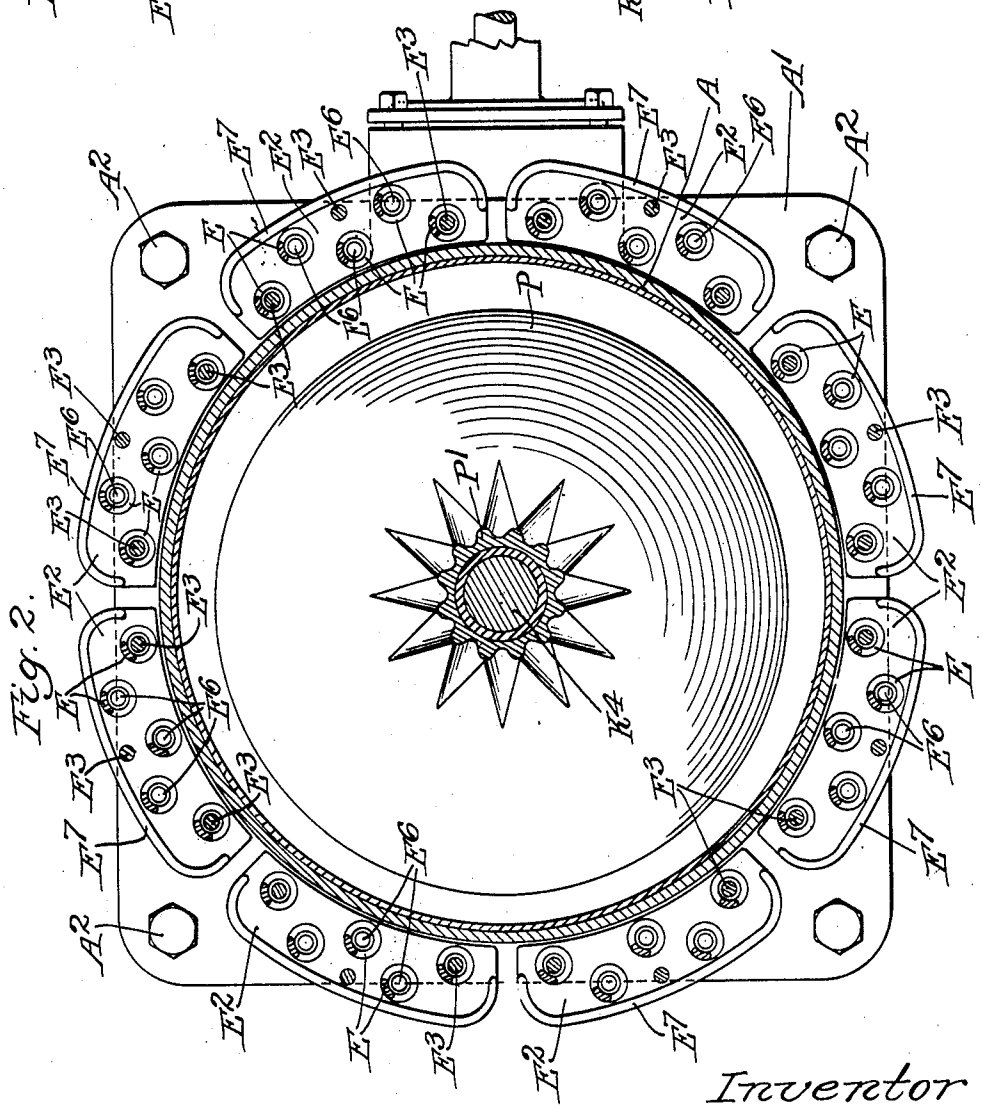


Fig. 2.



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Patented July 19, 1932 1,868,338

UNITED STATES PATENT OFFICE

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CRUSHING APPARATUS

Original application filed February 20, 1929, Serial No. 341,336. Divided and this application filed July 11, 1930. Serial No. 467,237.

My invention relates to a crushing device, and particularly to an improvement in crushing devices in which a cone is gyrated in a normally fixed concave or bowl.

One object of my invention is to provide a bowl, and supporting means therefor, which shall be normally maintained in fixed position but which shall be adapted to yield to a predetermined pressure in excess of normal crushing pressure or to permit the passage through the space between cone and bowl of uncrushable material. Another object is the provision of improved yielding means or members whereby this yielding is permitted. Another object is to provide an improved lubricating means and dust preventing means for a cone crusher of the type described. Other objects will appear from time to time in the course of the specification and claims. The present application is a division of my co-pending application 341,336, filed on February 20, 1929.

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a vertical axial section;

Figure 2 is a horizontal section on the line 2—2 of Figure 1; and

Figures 3 and 4 are partial horizontal sections through variant forms of my device.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, A generally indicates the main frame of a crushing device which may be formed at the bottom of any suitable base A^1, secured to a supporting surface, for example by the bolts A^2. A main frame section is shown, as in Figure 2, as cylindrical in cross-section. It is illustrated as terminating at its upper edge in a flange B, the top of which is inwardly beveled as at B^1 and outwardly beveled as at B^2 to receive the upper frame section or ring, generally indicated as C. The flange B projects outwardly from the body A of the frame. Or, stating it otherwise, the body or frame A is recessed within the outer periphery of the flange B. The purpose of this recessing or offset will later appear. The member C is provided with a laterally extending flange or flanges C^1, outwardly extending from the generally cylindrical portion C^2, the cylindrical portion being inwardly screw-threaded as at C^3. The flange or flanges C^1 are provided with the beveled surfaces C^4 and C^5, opposed to the beveled surfaces B^1 and B^2 of the portion B.

The member B is apertured to receive a plurality of aligning members, indicated as the pins D, with the flanges D^1 and the upwardly projecting portions D^2 shown as slightly tapered and rounded at the tip.

Positioned about the main frame A are a plurality of groups of springs E. The tops and bottoms of said springs are compressed between a plurality of sets of abutment members or segments, an upper abutment E^1 and a lower abutment E^2 being provided for each set of springs E. While I do not wish to be limited to any particular number or arrangement of springs, I have indicated, in Figure 2, as a practical arrangement, a plurality of sets of springs, five springs to a set, the springs being arranged in staggered relation with three springs arranged in an arc adjacent the face of the main frame and two springs positioned more distantly therefrom. In order to maintain the compression of the springs and to provide a bond between the lower abutment E^2 and the member C^1, I employ a plurality of bolts E^3 for each set of springs, said bolts being held at the top as at E^4 and being provided at the bottom with locking and adjusting nuts E^5, whereby the compression of the springs may be controlled. As an illustration, I have indicated three such bolts E^3 for each group of springs, two of said bolts being aligned with surrounding springs.

The member D serves to center the other of said springs, and it will be understood that, where necessary, axial lugs or plugs, such as E^6, are employed to maintain the springs properly aligned. E^7 indicates an outer rim about each such abutment member E^1 or E^2. It will be observed, as in Figure 1, that the effect of the spring assembly will be to draw the flange or rings C^1 downwardly against the flange or ring B, and to maintain the frame portion C^2 fixed in position in relation to the frame A.

In screw-threaded relation to the spring

C^2 is the bowl or concave supporting frame, generally indicated as G. It includes the cylindrical outer frame portion G^1, screw-threaded as at G^2 in opposition to the screw-threaded portion G^3 of the member C^2. It will be understood that rotation of the member G^1 in relation to the member C raises and lowers the bowl or concave, the means for effecting such rotation and adjustment being not indicated herein, since they form of themselves no part of the present invention. Inwardly and upwardly projecting from the lower edge of the member G^1 is the bowl support G^3, which is connected to the outer portion G^1 as by the webs G^4. The portion G^3 is apertured as at G^5 to permit the passage of securing lugs G^7 upon the bowl proper G^6. G^8 indicates any suitable locking means whereby, by engagement with the lugs G^7, the bowl G^6 can be brought up against the member G^3. The details of these locking means are not described with greater fullness herein, being the subject of a co-pending application, No. 310,988, filed on the 8th day of October, 1928.

Positioned upon the top of the member C^2 is a member, generally indicated as H. It includes a cylindrical portion H^1 and a generally horizontal top portion H^2, in which are formed a plurality of apertured bosses H^3, which receive the heads H^4 of the bolts H^5. H^4 is a nut upon said bolt, adapted to engage the lateral flanges or projections H^7 which is associated with the member G, whereby the tightening of the bolt H^5 will draw the member H downwardly against the upper edge of the frame member C^2, or rather, will raise the member G, in relation to C^2. It will be understood that the members H^7 project into pockets in the member H, whereby relative rotation of the members G and H is prevented.

Positioned within the inner periphery of the portion H^2 of the housing H is a cylindrical member J, within which is a hopper formed of segments J^1 resting upon a hopper shaped supporting surface J^2, which in turn is secured to the upper edge of the portion G^3, as by the bolts J^4. The details of this hopper structure do not, of themselves, form a part of the present invention and will not be further considered. The ring J^5 may be employed to engage the tops of the segments J^1, to hold them in position, the ring J^5 being held by the straps or abutments J^6 bolted as at J^7 to the upper edge of the ring J. A wiping member J^8 is provided intermediate the ring J and the housing H.

K generally indicates a generally cylindrical bearing sleeve associated with the main frame A and lying in the vertical axis thereof. Positioned therewithin is the eccentrically apertured sleeve K^1, associated with the gear K^2, which, meshing with the driving gear K^3, may be rotated from any suitable power source not herein shown. The crushing shaft K^4 penetrates the eccentric aperture K^5 of the sleeve K^1 and is gyrated in response to the rotation of said sleeve.

L generally indicates the bearing and guard member positioned above the sleeve K. It is indicated as having an upper spherical bearing surface L^1, and is surrounded by the oil-sump or peripheral passage L^3. The discharge passage L^3 is in communication with the space formed by the gear box K^{10} about the gear K^2. L^4 indicates a flange extending outwardly from the sump L^2 and having an upper spherical bearing surface L^5 and a lower spherical bearing surface L^6, both said surfaces being preferably concentric with the main spherical bearing surface L^1. L^7 indicates an oil groove in the face of the surface L^5, provided with passages L^8 extending to the bottom of the oil lamp. L^9 indicates an overhang or lip adapted to prevent any retrograde flow of lubricant to the bearing M^1.

M generally indicates a cone mounted on the upper end of the shaft K^4 and is provided with a spherical bearing surface M^1, conforming to and resting upon the surface L^1. M^2 indicates an axial oil passage in the shaft K^4, which is in communication with the lateral passage M^3 with the oil induct M^4 extending to the lower bearing surface M^1. It there communicates with the circumferential oil passage M^5, which in turn communicates with the radial passage M^6 extending to the wall of the shaft K^4, and being adapted to deliver oil downwardly along said shaft to the gear box K^{10} or to the bearing surface between shaft and eccentric sleeve. The crushing head M is provided with the outer conic surface portion, generally indicated as M^7, and terminating at its lower edge in the downwardly extending apron M^8. M^9 indicates an inner apron positioned exteriorly of the surface M^1. The members M^8 and M^9 have opposed parallel surfaces, indicated as M^{10} and M^{11}, within which slides the oil wiping member generally indicated as O, and having the flange O^1 and a spherical bearing surface opposed to the surface L^5 and a lower flange O^2 opposed to the surface L^6. Any suitable means, for example the springs O^3, are employed for thrusting the member O downwardly and for maintaining its upper member O^1 closely opposed to the upper bearing surface L^5 of the member L^4.

Positioned upon the head M^7 is any suitable mantle P, shown in conic form, with the upwardly extending central hub or top portion P^1 adapted to be engaged by the annular abutment P^2 controlled by the lock nut P^3 screw-threaded, as at P^4, to the upper screw-threaded extension K^{11} of the shaft K^4. The portion P^3 is provided at its upper end with an outwardly extending circumferential flange P^5, upon which is positioned any suitable feed limiting or feeding plate P^6. The

details whereby the lock nut P^3 is held against rotation, in such fashion that the mantle is clamped upon the cone, do not, of themselves, form part of the present invention and need not be considered in detail.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my drawings to be taken as, in a broad sense, illustrative and diagrammatic, rather than as limiting me to the specific features herein described and shown, except so far as I limit myself by the language of the claims.

The use and operation of my invention are as follows:

The invention relates to an improvement in cone crushers of the type wherein a spring release is provided for the bowl. In the larger size of crushers it is important that a sufficient number of springs be spaced about a bowl to hold it in position against all but excess crushing strains. I find it desirable to arrange the springs in a plurality of groups and to arrange the springs in each group at varying distances from the axis of the machine. These groups of springs are of sufficient power to hold the ring C^1 clamped firmly downwardly against the top of the frame A. On the other hand, if uncrushable material, such as tramp iron or caked stone, passes through the device, the springs are of such strength and set at such compression as to give sufficiently to prevent breakage or stoppage of the machine and to pass the troublesome substance or body. When the bowl and its support tilt upwardly to permit the passage of such material, the member C^1 is lifted from the member B. The bolts E^3 tend to maintain the alignment of the devices, but I prefer to employ, also, the pin or aligning members D, the upper ends D^1 of which insure that the member C^1 will not escape from its proper alignment and will not rotate in relation to the member B. Such rotation, of course, throws a strain upon the bolts and springs.

Whereas I have described and shown a particular arrangement of springs in groups, it will be understood that I do not wish to be limited specifically to it, except so far as I do limit myself in my claims and in particular I may employ a concentric arrangement of springs, two or more springs being positioned about the individual guides or bolts E^3 or about the members E^6, as shown in Figures 3 and 4. I have indicated in Figure 3 a form of my device in which I employ the inner spring R and the outer spring R^1 about each bolt or abutment. In the form of Figure 4 I illustrate a third external spring R^2, about the other two. It will be realized that whereas I have illustrated these multiple springs as shown in connection with segments E^2 that they may be applied independently of such segments, with any suitable means for guiding and centering them or for grouping them, when they are arranged in groups. The group arrangement is convenient but may not under all circumstances be necessary.

The member H is in effect a housing ring, and prevents the access of dust to the parts within it. It serves other primary purposes, however. The lateral projections H^7, as above described, prevent any relative rotary movement of the member H and the member G. Therefore the ring H may act as a wrench for turning the bowl G within the ring C. Any suitable means for causing rotation of the ring H, such means being not shown herein in detail, have for effect to rotate the member G and to cause the member G to raise or lower within the screw-threaded ring C^2. Assuming that the rotation is in such direction as to cause the member G to rise, it rises in relation to the member H which rests normally upon the top of the member C^2, upwardly projecting from the frame member C. The wiping member or washer J^8 provides a substantial dust proof connection between the inwardly projecting flange H^2 and the cylindrical member J about the hopper.

The bolts H^5, with their nuts H^6, serve to raise the member G, through the projections H^7, to relieve the contact of the threads on the opposed members G^1 and C^2. These threads are made with considerable play, and the act of crushing stone will lift the threads on the member G^2 and cause them to bound to the extent of the play between them and the opposed threads. It is in order to take up this play that the bolts H are introduced. By tighting the bolts H after the correct setting has been obtained, the play is taken up, as to the loose threads. The nuts H^6 lift up on the bowl and the ring H exerts a downward pressure upon the top of the member C^2.

The washers H^{10} may be made of fiber and may be interposed between steel washers, one above and one below. The washers H^{10} may for example be made of pieces of rubber belting. If a piece of steel goes through the crushing cavity, it causes the ring C to be raised in relation to the member A, this tilting yielding release being important to prevent breakage of the device. As soon as the head recedes and the steel, or other uncrushable substance, as pass from the crushing cavity, there will be a pronounced blow when the ring member C seats itself on the frame as at C^5. It is the function of the washers H^{10} to absorb or cushion this shock. In practice they furnish sufficient pressure to keep the threads in contact, so that there will be no pounding but they give sufficiently to pre-

vent stripping the threads on the bolts H^5.

The cone M is mounted upon a spherical bearing surface L^1, and this bearing surface is protected from the penetration of dust or the like, which would shortly wear it out, firstly by the circumferential oil sump and secondly by the outer guard member L^6 with its inner and outer spherical bearing surfaces in engagement with the inner and outer flanges of the dust guard member O.

The hopper above the cone is preferably formed of a plurality of removable, and preferably separately removable segments J^1. These segments or liners are subjected to heavy wear and may be made of manganese steel, being of course easily replaceable and being held in place for example upon the conic ring or supporting surface J^2, being held in position either by their form and inter-engagement, or by the rearward projections J^{10} which may project through the slots J^{11} of the member J^2. The ring J^5 serves to hold them against upward movement.

I claim:

1. In a gyratory crusher including a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing surface positioned exteriorly of and concentric with the main bearing surface and a closure ring member, mounted on said cone, in engagement with said second bearing surface, and means for thrusting said ring downwardly against said bearing surface.

2. In a gyratory crusher including a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing surface positioned exteriorly of and concentric with the main bearing surface and a closure ring member, mounted on said cone, in engagement with said second bearing surface, the cone being circumferentially recessed to receive said ring and means for thrusting said ring downwardly against said bearing surface.

3. In a gyratory crusher including a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a circumferential oil sump surrounding said bearing surface, a second bearing surface positioned exteriorly of said oil sump and concentric with the main bearing surface and a closure ring member, mounted on said cone, in engagement with said second bearing surface, the cone being circumferentially recessed to receive said ring and means for thrusting said ring downwardly against said bearing surface.

4. In a gyratory crusher including a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing surface positioned exteriorly of and concentric with the main bearing surface and a closure ring member, mounted on said cone, in engagement with said second bearing surface, and yielding means for thrusting said ring downwardly against said bearing surface.

5. In a gyratory crusher which includes a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing member positioned exteriorly of the main bearing surface, said second member being provided with upper and lower spherical bearing surfaces concentric with said main bearing surface, and a closure member associated with said cone, and bearing surfaces thereon in engagement with the upper and lower bearing surfaces of said second bearing member.

6. In a gyratory crusher which includes a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing member positioned exteriorly of the main bearing surface, said second member being provided with upper and lower spherical bearing surfaces concentric with said main bearing surface, and a closure member movably mounted upon said cone, and bearing surfaces thereon in engagement with the upper and lower bearing surfaces of said second bearing member.

7. In a gyratory crusher which includes a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing member positioned exteriorly of the main bearing surface, said second member being provided with upper and lower spherical bearing surfaces concentric with said main bearing surface, and a closure member movably mounted upon said cone, and bearing surfaces thereon in engagement with the upper and lower bearing surfaces of said second bearing member, and means for thrusting said closure member downwardly against said second bearing member.

8. In a gyratory crusher which includes a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a second bearing member positioned exteriorly of the main bearing surface, said second member being provided with upper and lower spherical bearing surfaces concentric with said main bearing surface, and a closure member movably mounted upon said cone, and bearing surfaces thereon in engagement with the upper and lower bearing surfaces of said second bearing member, and yielding means for thrusting said

closure member downwardly against said second bearing member.

9. In a gyratory crusher including a cone and means for gyrating it, a concave spherical surfaced main bearing member, the under side of the cone being formed to conform thereto, a circumferential oil sump surrounding said bearing surface, a second bearing surface positioned exteriorly of said oil sump and a closure member, associated with said cone, adapted to engage said second bearing surface, the inner wall of the sump being formed with an overhanging lip.

10. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding said cone, a supporting member for said bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of sets of springs positioned about said frame member, individual abutment segments engaging the tops and bottoms of the springs of each set and members associated with each such set and with such abutments, adapted to maintain said springs under compression.

11. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding said cone, a supporting member for said bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of sets of springs positioned about said frame member, individual abutment segments engaging the tops and bottoms of the springs of each set and members associated with each such set and with such abutments, adapted to maintain said springs under compression, said sets of springs being positioned exteriorly of said frame member.

12. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding said cone, a supporting member for said bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of sets of springs positioned about said frame member, individual abutment segments engaging the tops and bottoms of the springs of each set and members associated with each such set and with such abutments, adapted to maintain said springs under compression, the springs of each such set being arranged about the exterior of the frame, some of said springs being positioned closely adjacent said exterior and others being spaced more distantly therefrom.

13. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding said cone, a supporting member for said bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of sets of springs positioned about said frame member, individual abutment segments engaging the tops and bottoms of the springs of each set and members associated with each such set and with such abutments, adapted to maintain said springs under compression, the springs of each such set being arranged about the exterior of the frames, some of said springs being positioned closely adjacent said exterior and others being spaced more distantly therefrom, said more distant springs being staggered in the intervals between those close to the frame.

14. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding said cone, a supporting member for said bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of sets of springs, said springs being positioned about the exterior of the frame member, the frame member being recessed to receive them.

15. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding said cone, a supporting member for said bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of sets of springs, said springs being positioned about the exterior of the frame member, the frame member being recessed to receive them, and individual abutment segments engaging the tops and bottoms of each said set of springs and members associated with such segments, adapted to maintain the springs of the individual sets under compression.

16. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a frame member upon which said bowl is mounted, a screwthreaded adjusting connection between said bowl and said frame member and means for rotating said bowl, including a ring positioned above said frame member and about said bowl and in non-rotatable relation with said bowl.

17. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a frame member upon which said bowl is mounted, a screwthreaded adjusting connection between said bowl and said frame member and means for rotating said bowl, including a ring positioned above said frame member and about said bowl and in non-rotatable relation with said bowl, the connection between said ring and bowl being adapted to permit relative non-rotary move-

ment thereof along a generally vertical axis.

18. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a frame member upon which said bowl is mounted, a screwthreaded adjusting connection between said bowl and said frame member and means for rotating said bowl, including a ring positioned above said frame member and about said bowl and in non-rotatable relation with said bowl, and means associated with said ring adapted to relieve the pressure upon said screwthreaded adjusting connection and to take up the play of the screwthreads thereof.

19. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a frame member upon which said bowl is mounted, a screwthreaded adjusting connection between said bowl and said frame member and means for rotating said bowl, including a ring positioned above said frame member and about said bowl and in non-rotatable relation with said bowl, and means associated with said ring adapted to relieve the pressure upon said screwthreaded adjusting connection and to take up the play of the screwthreads thereof, said means including bolts depending from said ring and in engagement with said bowl.

20. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a frame member upon which said bowl is mounted, a screwthreaded adjusting connection between said bowl and said frame member and means for rotating said bowl, including a ring positioned above said frame member and about said bowl and in non-rotatable relation with said bowl, and means associated with said ring adapted to relieve the pressure upon said screwthreaded adjusting connection and to take up the play of the screwthreads thereof, said means including bolts depending from said ring and in engagement with said bowl, and shock-taking members associated with said bolts.

21. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a frame member upon which said bowl is mounted, a screwthreaded adjusting connection between said bowl and said frame member and means for rotating said bowl, including a ring positioned above said frame member and about said bowl and in non-rotatable relation with said bowl, and means associated with said ring adapted to relieve the pressure upon said screwthreaded adjusting connection and to take up the play of the screwthreads thereof, said means including bolts depending from said ring and in engagement with said bowl, and yielding washers associated with said bolts.

22. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a screwthreaded supporting member for said bowl, said bowl being screwthreaded to conform thereto, and means, associated with said supporting member, for relieving the pressure upon said screwthreads.

23. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a screwthreaded supporting member for said bowl, said bowl being screwthreaded to conform thereto, and means, associated with said supporting member, for relieving the pressure upon said screwthreads, such means including a member adapted to engage and be supported by said supporting member, and an adjustable connection between such last mentioned member and the bowl.

24. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a screwthreaded supporting member for said bowl, said bowl being screwthreaded to conform thereto, and means, associated with said supporting member, for relieving the pressure upon said screwthreads, such means including a member adapted to engage and be supported by said supporting member, and supporting elements depending therefrom and adapted to engage and support said bowl.

25. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a screwthreaded supporting member for said bowl, said bowl being screwthreaded to conform thereto, and means, associated with said supporting member, for relieving the pressure upon said screwthreads, such means including a member adapted to engage and be supported by said supporting member, supporting bolts depending therefrom and adapted to engage and support said bowl.

26. In a gyratory crusher, a cone and means for gyrating it, a bowl surrounding said cone, a screwthreaded supporting member for said bowl, said bowl being screwthreaded to conform thereto, and means, associated with said supporting member, for relieving the pressure upon said screwthreads, such means including a member adapted to engage and be supported by said supporting member, supporting bolts depending therefrom and adapted to engage and support said bowl, and yielding washers, associated with said bolts.

27. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl surrounding the cone, a supporting member for the bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of individual sets of springs, and an individual abutment member for each said set.

28. In a gyratory crusher, a frame member, a cone and means for gyrating it, a bowl

surrounding the cone, a supporting member for the bowl mounted upon said frame member and tiltable in relation thereto, and yielding means for holding said supporting member normally fixed in relation to said frame, said means including a plurality of individual sets of springs, and an individual abutment member being opposed to the lower ends of the springs of each such set, the upper ends abutting against the frame itself, the frame being outwardly offset to align with said springs.

29. In a gyratory crusher which includes a cone and means for gyrating it, supporting means for said cone, and a wiping connection for said cone, exterior to said supporting means, and adapted to prevent the access of foreign material thereto, said wiping connection including a closure ring member, a member opposed thereto, and yielding means for maintaining said member in closing position against said opposed member.

30. In a gyratory crusher which includes a cone and means for gyrating it, supporting means for said cone, and a wiping connection for said cone, exterior to said supporting means, and adapted to prevent the access of foreign material to said supporting means, a bearing surface opposed to said closure ring member and yielding means, interposed between the cone and the closure ring member, adapted positively to thrust said closure ring member downwardly against said opposed bearing surface.

31. In a gyratory crusher including a cone and means for gyrating it, a ball and socket support for the bottom of said cone, and a wiping connection for said cone, adapted to protect said ball and socket support, said wiping connection including a closure ring member mounted upon the cone, yielding means for positively thrusting it downwardly in relation to the cone, and a bearing member opposed to the closure ring member.

Signed at Hollywood, county of Los Angeles and State of California, this 14th day of June, 1930.

EDGAR B. SYMONS.