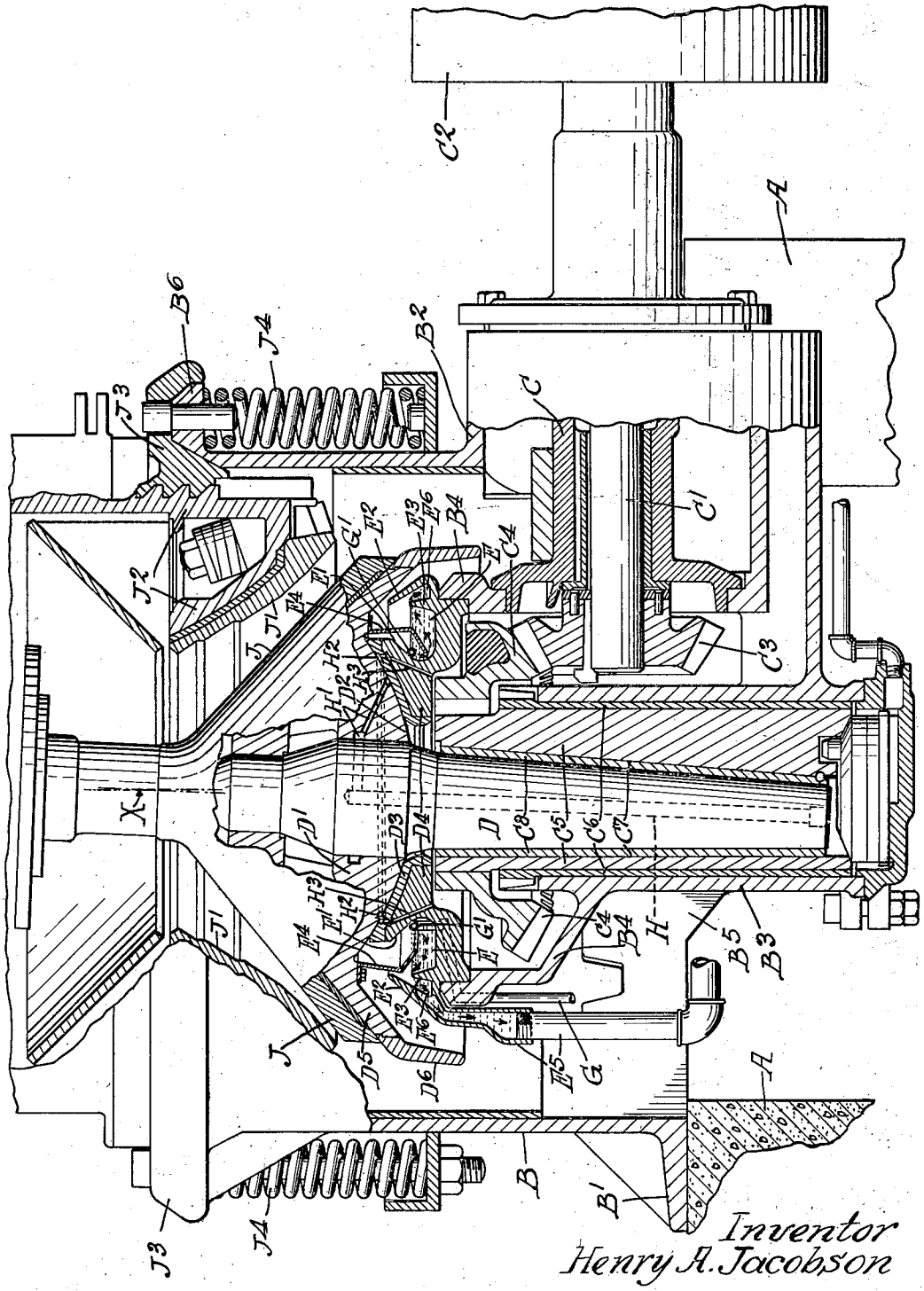
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WATER SEAL FOR USE WITH CRUSHING MACHINERY

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WATER SEAL FOR USE WITH CRUSHING MACHINERY

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My invention relates to an improvement in sealing means and shown herein as applied to sealing or protecting the main supporting bearing of the head of a gyratory cone crusher. It will be understood, however, that it may be applied to a variety of mechanisms and for a variety of purposes. One proposition is the provision of improved means for preventing the access of dust, dirt, grit or the like to an enclosed bearing. Another object, in relation to the specific application of the invention shown in the present specification is the prevention of access of foreign material to the main supporting bearing of a gyratory cone crusher. Other objects will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawing, which represents a vertical axial section through a gyratory cone crusher with my invention applied thereto.

Referring to the drawing, A generally indicates any suitable base or support of masonry, concrete or the like.

Mounted upon the base A is the main frame B having bottom flange B^1, which may be bolted or otherwise secured to the base A. The main frame B is provided with an upper flange B^6 and is formed at one side with a penetrating sleeve B^2. Supported upon and spaced generally centrally within the main frame B is a central vertical sleeve B^3. It may be outwardly enlarged or extended at its upper end as at B^4. It may be connected to the frame B by generally radial spider members B^5.

Mounted within the sleeve B^2 in any suitable manner is a bearing sleeve C, in which is rotatably mounted drive shaft C^1, which may be driven as by the pulley C^2. It terminates at its inner end in the pinion C^3 in mesh with the bevel gear C^4, which in turn is keyed to the eccentrically apertured shaft C^5 which rotates within a bushing C^6 in the sleeve B^3.

Mounted within the eccentric aperture C^7 of the shaft C^5 is a bushing C^8, in which rotates a shaft D, at the upper end of which is mounted the crushing head D^1. This head D^1 has a lower spherical bearing surface indicated at D^2. It rests upon the correspondingly surfaced bearing plate D^3, which in turn is mounted upon a cover plate D^4, which is seated upon the upper outer edge of the enlargement B^4 of the central vertical sleeve B^3. It will be understood that in response to rotation of the shaft C^1, the eccentric shaft C^5 is rotated through the pinion C^3 and the gear C^4. The rotation of the shaft C^5 rotates the aperture in which is seated the shaft D. This rotation imparts a gyratory movement to the head D^1. In the course of this movement the head seats upon and moves upon the spherical bearing formed by the member D^3. The parts are so proportioned that the head D^1 acts as if it were suspended at the point indicated as X above the top of the head proper. It will be noted also that the head D^1 has an umbrella-like extension D^5, which is down turned as at D^6 and extends downwardly about the cover plate D^4.

In order to protect the bearing formed by the opposed surfaces D^2 and D^3, I provide the following structure. E indicates a circumferential sump formed in the cover plate D^4. The sump is bounded inwardly by the upwardly and outwardly inclined face E^1 of the plate D^4. It is bounded exteriorly by the upward and inward extension E^2. Positioned between the two is an additional upward extension E^3 of less height than E^1 or E^2. Extending downwardly into the space between E^1 and E^3 is the skirt E^4, the upper edge of which is shown as secured to the head D^1, the lower edge of which is at all times and at all positions of the head below the plane defined by the upper edge of the member E^3. This will be clear from the drawing since the skirt E^4 is at the left side of the drawing shown in its highest position. In order to maintain a liquid seal, I keep the space between the members E^1 and E^3 at all times filled with a liquid, for example, water. To obtain this result, I employ a water supply pipe G extending from any suitable source of water to a circumferential supply pipe G^1 positioned at about the level of the upper edge of the partition E^3. The circulation of the water is indicated in arrows in the drawing and the water is so supplied as to keep at all times a liquid seal for the lower edge of the member E^4. Under many circumstances it may be preferable to maintain a circulation of water over the lip or upper edge of the partition E^3. The arrows indicate the direction of this circulation and it is advantageous in that any foreign matter, dust or the like, which reaches the surface of the water is carried off by this circulation. E^5 is any suitable overflow pipe for this water, one or more of such pipes being used, the pipe or pipes being in communication with the gutter E^6 between the members E^2 and E^3.

It will be observed from the drawing that the lower portion of the member E^4, that portion which penetrates the liquid E, is formed concentrically with the spherical bearing surface or member D^3. The purpose of this is to prevent any displacement of the liquid in response to the

movement of the member E^4, to prevent the member or skirt E^4 from throwing fluid out of the sump or causing an agitation thereof which would prevent the normal trickle or flow of the fluid over the lip E^3. It will be observed, from the right hand of the figure, that even when the head is at its lowest the generally vertical portion of the member E^4 does not penetrate the fluid, the fluid being penetrated only by the inturned spherical lower edge portion.

The bearing D^3 may be supplied by oil in any suitable manner as, for example, by an oil passage H extending axially up the shaft D, and a passage or passages H^1 extending through the head to supply oil to the opposed surfaces of D^2 D^3. I may find it desirable to prevent the escape of any of this oil over the edge of the bearing D^3. I indicate for example a circumferential oil groove H^2 formed in the member D^3, which communicates as by the oil passages H^3 with the space below the cover D^4. The oil is to be wiped off the bearing face D^2 and is returned through the oil passage or passages H^3 to the inside of the machine and hence back to whatever oil reservoir is employed. Thus no oil is permitted to escape over the edge of the bearing D^3 to be carried off and wasted with the water in the drain pipe. Any suitable means may be employed, to be understood, for maintaining the oil circulation and for cleaning the oil.

Any suitable crushing member or mantle J is mounted upon the head D^1. The details of this mantle and of the mounting therefor are not shown, since they do not of themselves form part of the present invention. The crushing surface of the mantle J is opposed to a concave or bowl liner J^1, which is mounted on any suitable bowl structure J^2, which in turn is provided with a circumferential flange J^3 adapted to seat upon the flange B^1 of the main frame. J^4 indicates springs adapted normally to hold the bowl fixed in relation to the main frame B.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless many changes may be made in size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my drawing and description to be taken as in a broad sense illustrative or diagrammatic rather than as limiting me to the precise structure herein described and shown. For instance, whereas I show it as applied to a gyratory cone crusher, it will be realized that a similar seal may be applied to other types of crushers or to entirely different structures where it is necessary to protect an inner bearing surface from access of grit or dirt from outside.

It will be realized that when I employ the terms "sump" and "skirt", I wish them to be interpreted with sufficient breadth to cover any equivalent structure in which a member, on one of two relatively movable parts, penetrates a body of liquid associated with the other.

The use and operation of my invention are as follows:

I illustrate a gyratory cone crusher in which the head D^1 is gyrated upon the spherical surface bearing D^3. If the crusher is employed to crush rock, it will be understood that finely divided particles, dust and grit fill the air about the crusher. It is in the highest degree important that such material be denied access to the bearing surface, as otherwise the bearing will rapidly burn out. The present invention is one solution of this problem.

The direct access of any large particles is made difficult by the tortuous passage formed by the overhanging umbrella D^5 D^6, and the interpenetrating partitions E^2, E^4 and E^1. In addition to this tortuous passage I provide a positive water seal which always overlaps the lower edge of the skirt E^4. Not merely do I provide a water seal, but I may maintain a positive outward circulation of water which carries off, preferably outwardly, any dust or grit which reaches the surface of the water in the sump E. A tortuous passage and the water seal and the circulation of the water combine to deny the access of outside dirt or grit to the bearing surface. It is further advantageous, in order to prevent oil wastage, that no oil be allowed to flow over the outer edge of the bearing D^3. I therefore provide the circumferential oil wiping pasages H^2, whereby the oil which would otherwise escape over the edge of the bearing D^3 is allowed to pass down the passages H^3 to the interior of the machine, where it returns to the general oil circulation system of the device. It will be understood that any suitable means are employed for maintaining a closed circulation of the oil, the oil being filtered or purified in any suitable manner.

I claim:

1. In a gyratory crusher, a crushing head and means for gyrating it, a spherical support for said head, said head and support being provided with opposed spherical bearings, means for supplying oil to said opposed bearings, means for withdrawing oil from said bearings adjacent the periphery thereof, a sump extending outwardly about said bearings, an apron normally fixed in relation to said head for penetrating said sump, means for supplying a flow of liquid to said sump within said apron, an overflow lip in said sump outside of said apron and extending circumferentially thereabout, gutter means positioned without said overflow lip, and an exhaust passage for drawing off liquid from said gutter means, the above described system of circulation through the sump being independent of the means for supplying oil and withdrawing oil from the spherical bearings, the level of liquid in the sump being defined by the overflow lip and being sufficiently high at all times to overlap the lower edge of the apron, and an upwardly extending baffle wall which extends upwardly about the sump and overlaps and closely approaches the apron.

2. In a gyratory crusher, a crushing head and means for gyrating it, a support for said head, head and support being provided with opposed bearings, means for supplying oil to said opposed bearings, means for withdrawing oil from said bearings, a sump extending outwardly about said bearings, an apron, normally fixed in relation to said head, adapted to penetrate said sump, means for supplying a flow of liquid to said sump, an overflow lip in said sump, outside of said apron, extending circumferentially thereabout, the effective overflow level of said lip being lower than the level of the bearings, gutter means positioned without said overflow lip, and exhaust passage means for drawing off liquid from said gutter means, the above described system of circulation through the sump being independent of the means for supplying oil and withdrawing oil from the bearings, the level of liquid in the sump being defined by the overflow lip and be-

ing sufficiently high at all times to overlap the lower edge of the apron at all positions of the apron.

3. In a gyratory crusher, a crushing head and means for gyrating it, bearing means for said head, and means for protecting said bearing means from dust, including a sump formed in the head support, an apron, normally fixed in relation to said head, adapted to penetrate said sump, means for supplying a flow of liquid to said sump, an overflow lip in said sump, extending circumferentially thereabout, gutter means positioned without said overflow lip, and exhaust passage means for carrying off said liquid from said gutter means, the level of liquid in the sump being defined by the overflow lip, and being sufficiently high at all times to overlap the lower edge of the apron at all positions of the apron, but being lower than the level of the adjacent portion of the bearings.

4. In a gyratory crusher, a crushing head and means for gyrating it, bearing means for said head and means for supplying oil thereto, and means, independent of said oiling means, for limiting the access of dust to said bearing means, including a sump, an apron on said head, penetrating said sump, a discharge lip, surrounding and positioned outwardly of said apron and out of contact with said apron at all times, an inner wall for said sump extending substantially above the horizontal plane of said discharge lip, and adapted to prevent access of the liquid to the bearing means, means for delivering a liquid to said sump at a point within the periphery of said apron, and for thereby causing a circulation of said liquid outwardly about the lower edge of said apron and over said discharge lip, the lower edge of said apron being at all times below the horizontal plane of the discharge lip, and run-off means for the liquid escaping over the discharge lip.

5. In a gyratory crusher, a crushing head and means for gyrating it, bearing means for said head and means for supplying oil thereto, and means, independent of said oiling means, for limiting the access of dust to said bearing means, including a sump, an apron on said head, penetrating said sump, a discharge lip, surrounding and positioned outwardly of said apron and out of contact with said apron at all times, an inner wall for said sump extending substantially above the horizontal plane of said discharge lip and substantially overhanging the sump and the liquid therein, and adapted to prevent access of the liquid to the bearing means, means for delivering a liquid to said sump at a point within the periphery of said apron, and for thereby causing a circulation of said liquid outwardly about the lower edge of said apron and over said discharge lip, the lower edge of said apron being at all times below the horizontal plane of the discharge lip, and run-off means for the liquid escaping over the discharge lip.

6. In a gyratory crusher, a crushing head and means for gyrating it, bearing means for said head and means for supplying oil thereto, and means, independent of said oiling means, for limiting the access of dust to said bearing means, including a sump, an apron on said head, penetrating said sump, a discharge lip, surrounding and positioned outwardly of said apron and out of contact with said apron at all times, an inner wall for said sump extending substantially above the horizontal plane of said discharge lip, and adapted to prevent access of the liquid to the bearing means, means for delivering a liquid to said sump at a point within the periphery of said apron, and for thereby causing a circulation of said liquid outwardly about the lower edge of said apron and over said discharge lip, the lower edge of said apron being at all times below the horizontal plane of the discharge lip, and run-off means for the liquid escaping over the discharge lip, and a shield, positioned outwardly of said apron, but out of contact therewith, said shield overlying the run-off means and the discharge lip.

7. In a gyratory crusher, a crushing head and means for gyrating it, stationary bearing means for said head and means for supplying oil thereto, and means, independent of said oiling means, for limiting the access of dust to said bearing means, including a portion of said stationary bearing means, a sump, a discharge lip, means for delivering a liquid to said sump, and for causing a constant flow of liquid over the edge of said discharge lip, a circumferential, imperforate apron, mounted on the head, and extending downwardly into the sump to a level below the plane defined by the surface of the water and the discharge lip, at all positions of the head, and run off means for the liquid escaping over the discharge lip, adapted to guide said liquid along a path separated from the bearing means.

8. In a gyratory crusher, a crushing head and means for gyrating it, bearing means for said head and means for supplying oil thereto, and means, independent of said oiling means, for limiting the access of dust to said bearing means, including a sump, a discharge lip, means for delivering a liquid to said sump, and for causing a constant flow of liquid over the edge of said discharge lip, a circumferential, imperforate apron, mounted on the head, and extending downwardly into the sump to a level below the plane defined by the surface of the water and the discharge lip, at all positions of the head, and run off means for the liquid escaping over the discharge lip, adapted to guide said liquid along a path separated from the bearing means, said apron terminating in a lower portion generally concentric with the center of gyration of the head, said concentric portion of the apron intersecting the surface of the liquid at all positions of the head.

9. In a gyratory crusher, a head mounted for movement about a predetermined center, supporting means for said head, and a seal for said supporting means including a sump, a body of liquid in said sump, and an apron, depending from said head and penetrating said sump, said apron including a spherical portion generally concentric with the center of movement of the head, said spherical portion at all times intersecting the surface of the liquid, at all normal crushing positions of the head.

10. In a gyratory crusher, a head mounted for movement about a predetermined center, supporting means for said head, and a seal for said supporting means including a sump, a body of liquid in said sump, and an apron, depending from said head and penetrating said sump, said apron including a spherical portion generally concentric with the center of movement of the head, and a circumferential generally vertical portion, from the lower edge of which the spherical portion inwardly extends, said spherical portion at all times intersecting the surface of the liquid, at all normal crushing positions of the head.

11. In a gyratory crusher, a head mounted for

gyratory movement about a predetermined center, supporting means for said head including a generally spherical bearing surface, and a seal for said supporting means including a sump, a body of liquid in said sump, and an apron depending from said head and penetrating said sump, said apron including a portion generally parallel to said spherical bearing surface and concentric with the center of movement of the head, said parallel portion of the apron intersecting the surface of the liquid at all normal crushing positions of the head.

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