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CRUSHING AND GRINDING MACHINE

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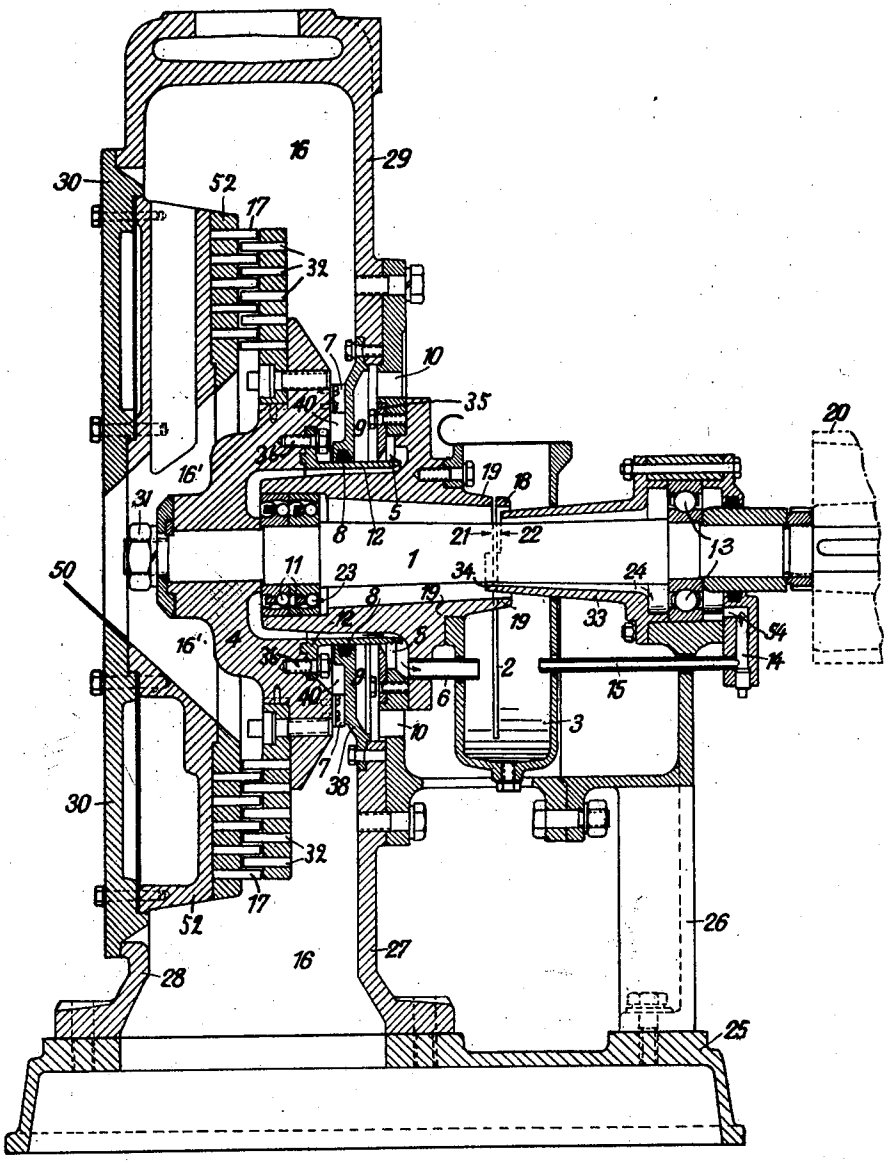

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CRUSHING AND GRINDING MACHINE

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This invention relates, generally stated, to a crushing and grinding mill of the rotary, high speed, type, and is more particularly concerned with novel lubricating provisions and features relative thereto.

Mills of the high speed rotary type, are used for various industrial purposes, chiefly for crushing and grinding, or rather to say, powderizing a variety of chemicals and other materials. The grade of powder, depends very much, among other things, on the speed of the machine. A number of important problems arise in connection with the lubrication of such a machine. The speed, in the ordinary, known type of mill, is greatly limited by the danger of dust or powder from the grinding chamber entering the lubricating system and thereby the bearings. It is, of course, apparent that the bearings would wear out very fast and that provisions must be made to separate the lubrication arrangement entirely from the grinding chamber. However, there is also the danger of oil entering the grinding chamber and mixing there with the chemicals. In certain cases this may lead to disaster, in nearly all cases it leads to spoilation of the substance to be grinded.

The invention, described in the present application, aims to avoid the above mentioned disadvantages of known mills, and discloses a number of novel features which make for higher efficiency of the machine.

One object of the invention relates to provisions for definite oil circulation, feeding oil automatically from a common oil chamber to a plurality of bearings, forcing the circulation of the oil until the same again returns to the common reservoir.

Another object resides in provisions for preventing oil or oil-fumes from entering the grinding chamber.

A further object of the invention is concerned with provisions attached to the rotating parts of the machine for definitely preventing dust and powder particles within the grinding chamber from entering the lubricating system.

There are numerous other objects coincident to the ones mentioned, which will be particularly explained in the detailed description of the invention which is yet to follow.

The invention is illustrated in the appended single sheet of drawings, which shows a cross section of a grinding and crushing mill of the high speed type, embodying the features and the objects which are comprised in my invention. The drawing, it will be understood, is a schematical representation of a machine of a certain type and is presented for the purpose of illustrating one form of carrying out the invention, without, of course, covering all possibilities. There are other manners of reducing the invention to practice, which I shall not enter into at all. Accordingly I want to have it understood that the example which is being described and explained does not cover the entire field.

Parts not relating to the invention or not necessary for its understanding have been omitted for the sake of convenience and clarity. In the following detailed description, reference will be made to the general structure of the machine only when necessary for illustrating the operation or structure of parts and details relating to the invention.

It will be advisable, to furnish first a brief account of the general operation of the machine, so that the invention may be better understood on the ground of this knowledge.

The machine consists, of a base 25, on which are mounted the frame parts 26, 27 and 28. These frame parts carry, respectively, the shaft bearing apparatus, and they form the chamber 16 which is closed at the upper end by a frame member 29. Mounted on ball bearings 11 and 13 is a shaft 1, which, at the front end carries the grinding head 4, attached to it by means of the nut 31. The grinding head 4 carries a number of grinding pins 32 which, during rotation of the shaft 1, mesh with the stationary grinding pins 17 mounted in supports 52 on the front frame 30. The material which it is desired to crush or grind to powder is put into the grinding machine 16′ at 50 through an opening at the front of the machine, whereupon the shaft, and with it the grinding head 4, is set to revolve at high speed.

By the action of the grinding pins 17 and 32, the material will be powderized and then removed in some convenient fashion from the chamber 16. Numeral 20 indicates part of a driving mechanism for rotating the shaft 1.

The detailed description, particularly with reference to the subject matter and to the scope of the invention, will now be proceeded with.

The shaft 1 which is mounted between the non-frictional bearings 11 and 13, is, as will be seen from the drawing, tapered in both directions from the bearings toward the center, the direction of the tapering being indicated by arrows designated by numeral 21 and 22. A lubrication ring 2, extending into the oil-container 3 furnishes in well-known manner oildrops to the center of shaft 1. Since the shaft is tapered in both directions, it will carry the oil during rotation away from the center part, in both directions, toward the ball bearings 11 and 13. It will be seen that the frame member 33, which forms part of the support of the ball bearings 13, extends into the frame member 19 and at its lower half 34 is projecting through the lubrication ring 2, thereby ascertaining the application of oil also to the left part of shaft 1. It will also be seen from the drawing that the inside of the frame members 19 and 33 are tapered toward the center. Now, when the lubrication ring 2 transports oil, on top of the revolving shaft 1, the oil will partially drip down, will be caught on the tapered insides of the frame parts 19 and 33 and flow to the left and to the right toward the ball bearings 11 and 13 as indicated by the arrows 23 and 24.

The path of the oil through the ball bearing 13 in the direction of the arrows 24 and 54, through the boring in member 14, and through the oil tube 15, back into the oil container 3, is plain and need not be discussed further.

However, the passage of the oil through the bearing 11 and then in the direction of the arrows through the oil chamber 5 and through the oil tube 6, back into the oil container 3, will need a more detailed description, since important features are connected with the provisions conducting the oil on the last described path.

A bushing 12 is attached to the grinding head 4 by means of screws 36. The grinding head, is thereby extended to the back, and this bushing 12 furnishes means and ways for definitely separating the lubricating system from the grinding chamber 16 and for providing several features which prevent the flow of oil into the grinding chamber on the one hand and which on the other hand prevent the entering of powder or dust from the grinding chamber into the oiling system.

The grinding head 4 which is firmly attached to the shaft 1, revolves, of course, at high speed, so that oil flowing through the bearing 11 and back through the passage provided by the bushing 12 and the frame part 19, is forced against the bushing by centrifugal force, and will finally, at the end of the bushing 12, enter and collect in the oil chamber 5. From the oil chamber 5 it will flow through the tube 6 into the oil container 3. The oil chamber 5 in part is bounded by the ring 35 which is fastened to the stationary frame 19 by means of screws.

Fastened to the frame members 27 and 29 is the member 38 which carries the dry packing 8. Thus, it will be seen that the chamber 16 is separated from the lubricating system by the packing 8 which fits snugly to the revolving bushing 12 and by the ring 35, the inner edge of which approaches very closely to said bushing 12.

As has been mentioned in the beginning of this specification, it is very important that dust and powder in the chambers 16 and 16′ be strictly prevented from entering the lubricating system. In order to reach this effectively, I have attached a plurality of circularly arranged wings 7 to the revolving grinding head 4. These wings, it will be seen, are attached at the only place of the grinding chamber from which dust or powder could possibly enter the lubricating system. When the grinding head 4 revolves, the space 40 between the grinding head and the member 38 is protected by the revolving wings 7. Their action, as far as the grinding chamber is concerned, is comparable to the action of a fan. Dust and powder will be blown away from the space 40 by these revolving wings so that they cannot enter the lubricating system by way of the tiny passages through the dry packing 8 and the edge of ring 35.

When the revolving head 4 during the operation of the machine rotates at very high speed the wings 7 might effect a sort of suction action through the passages in the packing 8. This is not at all desirable, as this effect includes the danger that the oil or oil vapours enter into the chamber 16′ together with the upsucked air.

It will be readily seen, that the air chamber 9, defined in part by the member 38, is provided with a number of openings 10 to the outside air, which will prevent the low pressure region created by the rotating wings 7, from extending backwardly into the oil chamber 5. Thus, the suction created by the wings 7 will merely result in drawing fresh air into the grinding chamber 16, and will not in the least be effective to the oil chamber 5.

Therefore, oil or oil fumes from the lubricating system will not be able to enter the grinding chamber 16, and dust or powder

from the grinding chamber will be unable to enter the lubricating system.

Even in the case that so high a static pressure should, for some reason or other develop in the grinding chamber 16, that dust and powder particles are blown through the space 40 and past the packing 8, they will not at all enter the oil chamber 5 and with it the lubricating system but will escape to the outside by way of the air chamber 9 and the several, circularly arranged, openings 10.

It is believed that the above description will enable anyone to scrutinize the drawing and to fully understand and appreciate the scope and all the features of my invention. It will also be seen that by my invention, I have succeeded in solving the problem of separating the grinding chamber from the lubricating system which is of utmost importance in the design and operation of high speed grinding and crushing machines of the type described. The chief advantages resulting from my invention are high speed of the rotor beyond the limits which were hitherto known; safety and certainty of operation; and preservation of the mechanism due to clean and efficient lubrication. Many modifications may occur which I have neither shown nor described in this specification. However, I intend to claim as my invention any modification or any feature used, which may fall within the scope of the appended claims.

What I claim is:

1. In a grinding and crushing machine for pulverizing material, a crushing and grinding chamber, a rotor operative in said chamber, a shaft rotatably mounted in a plurality of ball bearings and to which said rotor is attached, an oil container, means for continuously feeding oil to said bearings while said shaft and rotor are revolving, means for guiding said oil through said bearings and back to said container, an oil chamber located in the oil path between one of said bearings and said oil container, a first and second means for isolating said oil chamber from said grinding chamber, an air chamber located between said first and said second separating means and having openings communicating with the atmosphere and means attached to said rotor within said grinding chamber for continuously preventing the passage of particles of material to the part of said chamber adjacent said first separating means.

2. In a crushing and grinding machine, a grinding chamber, a rotor extending into said grinding chamber, a rotatable shaft for actuating said rotor, an oil container, lubricating means for continuously feeding oil to the revolving parts while said shaft and said rotor are in operation, means for circulating the oil fed to said revolving parts from the oil container and back again, a packing and a second means for separating said lubricating system from the grinding chamber, and an air chamber arranged adjacent said packing and provided with openings to the outside air.

3. In a grinding and crushing machine for pulverizing material, in combination, a grinding chamber, an automatic lubricating system continuously operating while said machine is in action, an air chamber having a plurality of openings to the atmosphere, means for separating said lubricating system from said air chamber, means for separating said air chamber from the grinding chamber, and means within said grinding chamber for impeding the passage of pulverized material to the part of said grinding chamber immediately adjacent said air chamber.

4. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, and means forming a path for passing oil toward and from said bearing, said rotor structure comprising a sleeve-like member disposed substantially concentrically about said support and defining a part of said path.

5. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, and means forming a path for passing oil toward and from said bearing, said rotor structure comprising a sleeve-like member disposed substantially concentrically about said support and defining a part of said path, said support and said rotor structure defining a part of said path closely adjacent said bearing and said sleeve-like member defining a part of said path further removed from said bearing.

6. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, means forming a path for passing oil toward and from said bearing, said rotor structure comprising a sleeve-like member disposed substantially concentrically about said support and defining a part of said path, and means substantially preventing passage of material from said path to said chamber and vice versa.

7. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, means forming a path for passing oil toward and from said bearing, said rotor structure comprising a sleeve-like member disposed substantially concentrically about said

support and defining a part of said path, and means substantially preventing passage of material from said path to said chamber and vice versa, said last named means comprising a plurality of spaced devices coactable with said sleeve-like member.

8. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, means forming a path for passing oil toward and from said bearing, said rotor structure comprising a sleeve-like member disposed substantially concentrically about said support and defining a part of said path, and means substantially preventing passage of material from said path to said chamber and vice versa, said last named means comprising a plurality of spaced devices coactable with said sleeve-like member, one of said devices being a packing ring and another of said devices forming an edged ring.

9. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, means forming a path for passing oil toward and from said bearing, and means for substantially preventing pulverized material from passing to said path from said grinding chamber, said last named means comprising mechanism for drawing air into said grinding chamber along a course leading toward said path.

10. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, means forming a path for passing oil toward and from said bearing, and means for substantially preventing pulverized material from passing to said path from said grinding chamber, said last named means comprising mechanism for drawing air into said grinding chamber along a course leading toward said path, said mechanism comprising fan structure and substantially all of the air actuated thereby coming from the outside atmosphere and not from said path.

11. In a grinding machine, a grinding chamber, a shaft, a support for said shaft, rotor structure carried by said shaft and disposed in said grinding chamber, a bearing interposed between said support and said shaft, means forming a path for passing oil toward and from said bearing, said rotor structure comprising a member which defines a part of said path, means substantially preventing passage of material from said path to said chamber and vice versa, said last named means comprising a plurality of spaced devices coactable with said member and forming a supplementary chamber open to the atmosphere, and fan structure for drawing air into said grinding chamber along a course leading to said supplementary chamber.

In testimony whereof I hereunto affix my signature.

OTTO GAISER.