Jan. 1, 1952 J. L. NEENAN 2,580,579

COMBINATION DISK AND IMPACT GRINDING MILL

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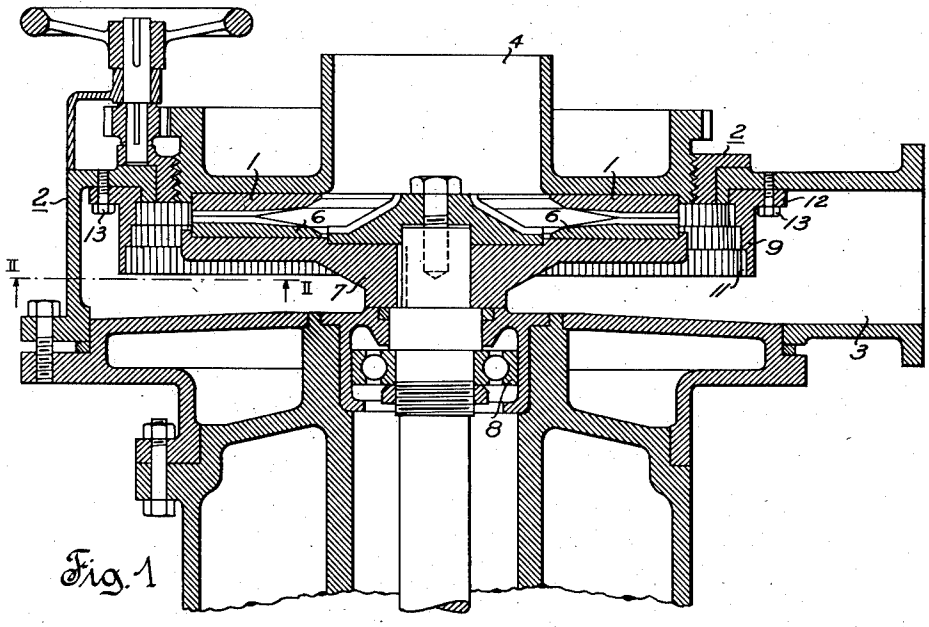


Fig. 1

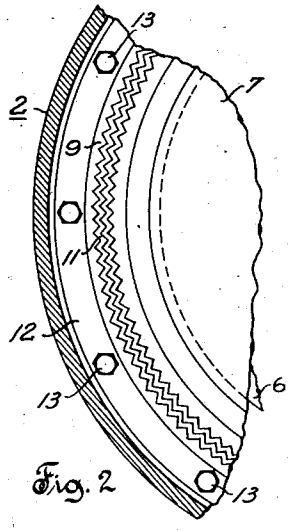


Fig. 2

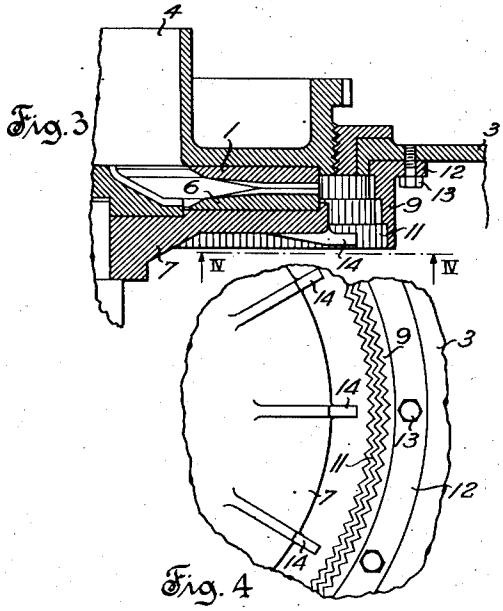


Fig. 3

Fig. 4

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COMBINATION DISK AND IMPACT GRINDING MILL

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1 Claim. (Cl. 241—152)

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This invention relates to improvements in grinding mills, more particularly mills of the disk type.

Specifically the invention concerns improving the grinding effect of a pair of disks by placing in the paths of particles discharged at high velocities at the periphery of the inter-disk grinding space an annular anvil surface, against which the discharged particles will impinge and be further reduced by impact, thus utilizing the kinetic energy imparted by the attrition grinding action of the disks to effect further reduction by impact on the anvil surface.

Another feature of the invention concerns provision of beater arms on a rotating disk of a disk grinding mill with annular impact anvil, in such relation to the anvil and disks as to cooperate in still further reducing particles before discharge from the mill casing.

An object of the invention concerns an improvement of disk type grinding mills to efficiently utilize the kinetic energy of particles being discharged at the peripheries of the disks to promote further reduction by impact.

A still further object concerns provision of an improved grinding mill combining in a single casing attrition and impact grinding effects in a novel cooperative relationship.

A still further object concerns increasing the effectiveness of disk type mills in promoting dispersion of colloids in wet grinding of colloidal mixtures.

The above and still further objects and advantages, which may become apparent through a reading of this specification, may best be carried into practical effect as described hereinbelow with reference to the accompanying drawing in which like reference characters indicate the same or similar parts throughout the several views.

In the drawing:

Fig. 1 is a vertical section through a grinding mill according to the present invention;

Fig. 2 is a fragmentary section taken on the line II—II of Fig. 1;

Fig. 3 is a fragmentary view similar to Fig. 1 of a modified form of the invention;

Fig. 4 is a fragmentary section taken on line IV—IV of Fig. 3.

In the embodiment of the invention shown in the drawing, a conventional disk grinding mill is equipped with an upper stationary disk 1, adjustably mounted in a casing 2, having a ground material discharge outlet 3. Disk 1, having any known suitably formed grinding surface, is annular in form, and is mounted coaxial to, and radially surrounding central inlet opening 4 of casing 2. A movable disk 6 is rotatably mounted in axially opposed relation to disk 1, as on a carrier 7 journaled in bearing 8, and is rotated at high speed by suitable driving means (not shown).

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The mill arrangement thus far described is entirely conventional; and it will be understood that materials charged into opening 4 will be thrown outwardly by centrifugal force resulting from motion imparted by contact with rotating carrier 7 and disk 6 and will be ground by attrition between the relatively rotating grinding surfaces of disks 1 and 6 and discharged at high velocity through the annular orifice defined by the opposed peripheral edges of disks 1 and 6. This effect is well known and understood to the art, and forms no part of the present invention, except as combined with additional effects as described hereinbelow. The material entering opening 4 may include a liquid grinding medium such as water where the machine is employed to do wet grinding. Casing 2 is liquid tight to provide for wet grinding.

In the preferred embodiment of the invention, an impact anvil, or skirt 9 of annular cylindrical form, having a roughened, or longitudinally corrugated, inner surface 11, is secured within casing 2, as by flange 12 and screws 13, in coaxial relation to the grinding disks 1 and 6. Skirt, or anvil, 9 is of such internal diameter and axial length and location that its inner, or anvil surface is substantially radially spaced from, and surrounds the peripheries of, disks 1 and 6 and the annular orifice therebetween.

It will be seen that the skirt, or anvil, 9 cooperates with the disk grinding mill elements to present an anvil surface 11, against which particles of material partially ground between disks 1 and 6 will be further reduced by impact. Since the skirt is a complete annulus, all particles discharged from the disks must undergo a change of direction of travel before being discharged at 3; and the impact grinding effect is thus made available as to substantially all particles discharged tangentially from the grinding space between the disks 1 and 6.

The swirling motion of the particles discharged by the disks into the annular space between the disks and surface 11, will result in repeated impact of such particles on roughened anvil surface 11, before discharge at 3. Thus, a large part of the kinetic energy acquired by the particles in the disk grinding effect will be utilized in grinding by impact, through use of the present invention.

In wet grinding this action will greatly increase the dispersion of particles in the liquid medium.

In the modification shown in Figs. 3 and 4 of the drawing, radially extending beater arms 14, which may be formed as integral parts of disk 6 or carrier 7, extend, preferably at angularly spaced intervals, into the space between disk 6 (or carrier 7) and surface 11 of skirt 9. These beater arms 14, rotating with disk 6, will impinge upon particles entering their plane of rotation, that is, such particles as are discharged by disks 1 and 6, and such as rebound after contact with anvil surface 11, and will further reduce such particles by impact, and cause the same to be thrown outwardly into repeated contact with surface 11. Thus a hammermill effect is added to the attrition, and impact effects resulting from the combination of disks 1 and 6 with skirt or anvil 9.

By reason of the combined effects of the present invention, the one-pass grinding effect of the mill is vastly improved, in comparison to the plain disk mill without the combined effects. And a significant increase is made in the capacity of the mill for fine grinding, with resultant economy of equipment, since in accordance with the invention, two or more grinding effects are accomplished in a single machine, having but a single rotating part.

The improved mill embodying the invention will be found particularly effective in wet grinding, for producing colloidal mixtures. Addition of the impact skirt 9, or the impact skirt 9 and beater elements 14, will greatly increase the dispersion in the liquid medium, of materials being ground. The annular space between the peripheries of disks 1 and 6 and skirt 9, will act, in wet grinding, as a turbulence chamber, the corrugations of skirt 9 acting as turbulence creating baffles as well as impact anvils. The turbulence created aids in improving dispersion and promoting homogeneity of the discharged mixture.

While specific apparatus is described and illustrated herein, it will be understood that the present invention includes such modifications and equivalents as may readily occur to persons skilled in the art to which it appertains, within the scope of the appended claim.

It is claimed and desired to secure by Letters Patent:

In a grinder of the type having opposed upper and lower relatively rotating annular disks defining an annular grinding space having an annular central feed opening and a peripheral discharge opening between peripheral edges of said disks, said lower disk being rotatable at a higher speed than said upper disk, said lower disk being provided with beater arms extending radially beyond and in axially spaced relation to said peripheral discharge opening, an inwardly corrugated annular anvil skirt entirely surrounding said disks and said beater arms, the portion of said skirt radially adjacent said peripheral discharge opening serving to provide a plurality of anvil surfaces against which material discharged at high velocity through said discharge opening will be further ground by impact, and the portion of said skirt radially adjacent said beater arms serving to provide a plurality of anvil surfaces against which material thrown by said beater arms is still further reduced by impact.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
277,790	Requier	May 15, 1883
295,049	Raymond	Mar. 11, 1884
657,656	Heine	Sept. 11, 1900
982,516	Marks	Jan. 24, 1911
990,633	Campbell	Apr. 25, 1911
1,764,760	Soule	June 17, 1930
2,031,289	Van Law	Feb. 18, 1936
2,059,249	Kopf	Nov. 3, 1936
2,126,776	Hogg	Aug. 16, 1938
2,218,876	Eirich	Oct. 22, 1940
2,365,179	Egedal	Dec. 19, 1944
2,389,505	Hall	Nov. 20, 1945