June 28, 1932. K. E. E. HOLZAPFEL 1,864,542

GRINDING BODY

Filed May 31, 1930

Fig. 1.

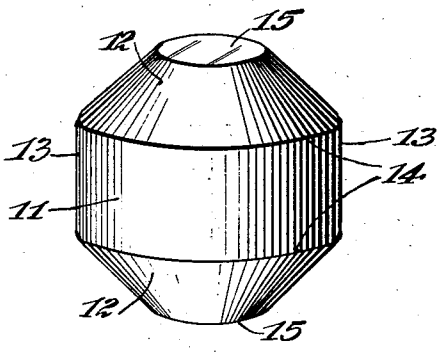


Fig. 4.

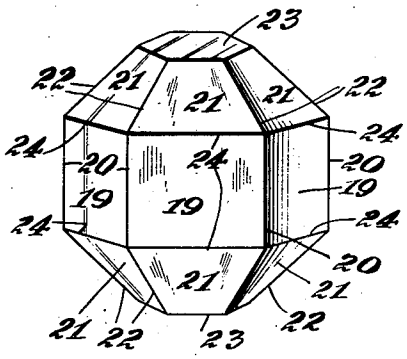


Fig. 2.

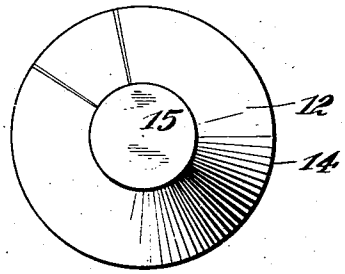


Fig. 5

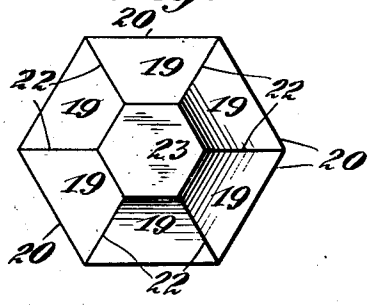


Fig. 3.

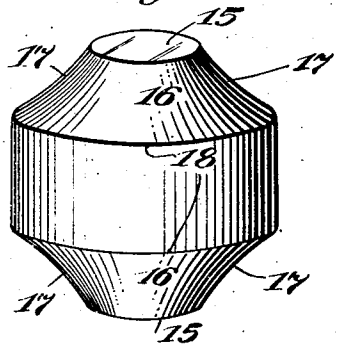
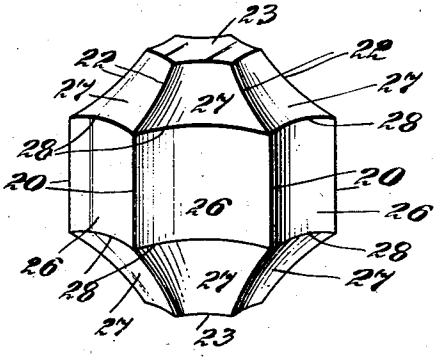


Fig. 6.



INVENTOR

Dr. Karl Ernst Eberhardt Holzapfel

BY C. F. Wepel

his ATTORNEY

Patented June 28, 1932 1,864,542

UNITED STATES PATENT OFFICE

KARL ERNST EBERHARDT HOLZAPFEL, OF MUNSTER, GERMANY, ASSIGNOR TO FRIED. KRUPP GRUSONWERK A. G., OF MAGDENBURG-BUCKAU, GERMANY, A CORPORATION OF GERMANY

GRINDING BODY

Application filed May 31, 1930, Serial No. 458,083, and in Germany June 11, 1929.

This invention relates to grinding bodies for use in mills and rotary drums of the type wherein vitrified or fused matter, or coarse substances, such, for instance, as clinkers, are broken up, ground and reduced to a pulverized or powdered state.

In mills and tumbling cylinders, wherein coarse matter and clinkers are reduced to a finer state, the use of iron bodies for beating and pounding the material is well known. In the grinding of cement, the art for which my improved grinding bodies have been especially designed, though they are by no means confined thereto, loose iron bodies both round and irregular in form, have been used for reducing the more or less vitrified or fused clinkers into a pulverized state. It has been found, however, that these known bodies, although having a satisfactory pounding action, lack grinding efficiency.

I have found, especially in the grinding of cement, that the grinding period is greatly shortened and expensive labor and power accordingly reduced, if the loose grinding bodies are made with grinding edges of not too small an angle. It is in place to emphasize here that the edge angles should not be too pointed, for in such case they will wear off too rapidly, so that the economies effected in one direction will be offset by extra expense incurred in another direction.

One of the objects and purposes of my invention is the provision of grinding bodies which have the desired edge angles and which are so shaped that they will have a relatively small surface and still possess the greatest possible weight. In this connection, it will be realized that the bodies must be economical in production, and therefore must be shaped in a manner suitable for such economical production.

In carrying out my invention in practice, I have found that the best technical and economical values are obtained when the grinding bodies are made with angle edges varying between 120° to 135°, and when the bodies are produced with cylindrical or prismatical central portions between end portions.

In some instances, it is advantageous to make the frustum-shaped end portions with concave cavities. By so doing sharper edge angles are obtained. These cavities should be in a horizontal direction, transversely of the prism faces, so that the surfaces of the central portion will be parallel with the vertical axis of the grinding body in order not to interfere with the stamping and forging of the bodies.

With the above and other objects in view, the invention consists in the improved grinding body and in the form, construction and relative arrangement of its several parts, as will be hereinafter more fully described, illustrated in the accompanying drawing and subsequently incorporated in the subjoined claims.

The invention will best be understood by reference to the accompanying drawing, forming a material part of this application, wherein I have illustrated several simple and practical embodiments of the invention, and in which:—

Figure 1 represents an elevation, more or less in perspective, of a grinding surface made in accordance with my invention;

Fig. 2 is a top plan view thereof;

Fig. 3 represents a modified form of construction, showing the conical end sections produced with concave cavities;

Fig. 4 illustrates a hexagonal form of the device;

Fig. 5 represents a top plan of the form of device shown in Fig. 4; and

Fig. 6 represents a further modification, showing a hexagonal form with concave cavities in its faces.

Referring with more particularity to the accompanying drawing, and first to the simplest form of construction shown in Figs. 1 and 2, it will be seen that my grinding device comprises a solid body made of iron or steel and having a central cylindrical portion 11 and opposite end sections 12, 12 having the form of truncated cones. The perimeter 13 of the central cylindrical portion 11 is parallel to the central axis of the body and external edge angles 14 mark the union of the perimeter of the cylindrical portion with the oblique surfaces of the cone-shaped sections.

In this way I provide a solid grinding body so shaped that it will have a relatively small surface and still possess the greatest possible weight, and in addition to this I provide the two exterior edge angles 14 in the parallel planes where the base boundaries of the cone sections join the perimeter of the cylindrical portion. The external edge angles so formed may vary in dimension as desired, but it has been found in practice that it is best not to make them smaller than 120° and not larger than 135°. In use, when a large quantity of the grinding bodies are placed loosely in the usual way within the mill or tumbling barrel, wherein the clinkers or other coarse materials are subjected to the pounding and beating action of the grinding bodies, the edge angles 14 serve as effective means for biting into the clinkers, thereby effecting rapid disintegration of the same. Therefore, the time required for reducing the coarse substances to a pulverized or powdered state, is greatly shortened so as to reduce correspondingly the expense of labor and power for handling a particular volume of coarse substances. Grinding edge angles made in the manner described, while rendering effective service in shortening the grinding operation, will serve for a considerable period of time in grinding the materials; and in view of their form, in which the perimeter of the central portion is parallel to axis of the body and in which the oblique faces of the truncated cones extend oppositely from the ends of the central portion, the grinding bodies may be produced in an inexpensive way either by stamping or forging.

In the exemplification shown in Fig. 3, the structure of the grinding body is essentially the same as that of Figs. 1 and 2, except that the faces 16 of the truncated cones are produced with concave cavities 17 therein, which concave cavities extend, as shown, entirely around the oblique faces of the cones between the end cutting planes thereof and the external edge angles 18 which are formed with the perimeter of the central cylindrical portion. In this way, the edge angles may be somewhat more pointed and yet be produced in a manner that they will withstand long wear.

In Figs. 4 and 5, I have disclosed the grinding body as produced in the form of a polygonal figure. In this embodiment, the central portion is of hexagonal form, having six faces 19 and a corresponding number of edge angles 20 which are parallel to the axis of the body. The frustum sections are also represented as being of hexagonal form having six faces 21 and a corresponding number of edge angles 22 which comprise continuations of the edge angles 20 and lead obliquely to the cutting planes 23 of the frustums. At the bases of the frustums, where their faces 21 join with the faces 19 of the central portion, there are produced external edge angles 24 in planes parallel to the cutting planes 23. Numerous edge angles are thus produced for the purpose of hastening the reduction of the coarse substances to a powdered state, and these numerous edge angles are produced without greatly reducing the weight of the grinding body.

In Fig. 6, in which I disclose another hexagonal form, the faces between the straight edge angles 20 are formed with concave cavities 26; and similarly the faces between the edge angles 22 of the frustum sections are made with concave cavities 27. As a result of the provision of the concave cavities 26 and 27, the transverse edge angles 28 are also of a curved or concave form, as shown. This arrangement of edge angles is designed to further expedite the reduction of the coarse substances to a pulverized state. Instead of making the grinding bodies in hexagonal form, as shown in Figs. 4, 5 and 6, they may be produced in a similar manner in octagonal form, so that both the central body and frustum sections will have eight faces and edge angles.

It will be manifest from the foregoing that I have disclosed a thoroughly satisfactory grinding body for use in mills and tumbling cylinders, wherein coarse substances are reduced to a pulverized or powdered state, and one which embodies the features of advantage enumerated in the statement of invention and the above description; and while I have, in this application, shown and described several selected embodiments of the invention, as reduced to practice, it is to be understood that the particular embodiments set forth are susceptible of modification in various particulars without departing from the spirit or scope of my invention or sacrificing any of its advantages.

I claim:—

1. A grinder for the purpose set forth, comprising a solid body characterized by having a central cylindrical portion and end sections at either end thereof in the form of truncated cones, the perimeter of the central portion between the end sections being parallel to the axis of the body, the outer boundaries of the cone bases forming at the ends of the cylindrical portion, exterior grinding angles with the perimeter of the cylindrical portion, and the surfaces of the cones between the cylindrical portion and the cutting planes of the cones being provided with cavities concaving toward the axis of the body to give the grinding angles at the ends of the cylindrical portion and as well the grinding angles formed with the cutting planes of the cones, a form that will endure long grinding wear.

2. A grinder for the purpose set forth, comprising a solid body characterized by having a central portion and end sections forming therewith external grinding angles which

extend transversely to the axis of the body, said central portion and end sections having bounding surfaces consisting of a series of concavities separated by grinding angles, extending longitudinally of the axis of the body, the curving of the concavities of the central portion being in a direction transverse to the curving of the concavities of the sections.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

Dr. KARL ERNST EBERHARDT HOLZAPFEL.