

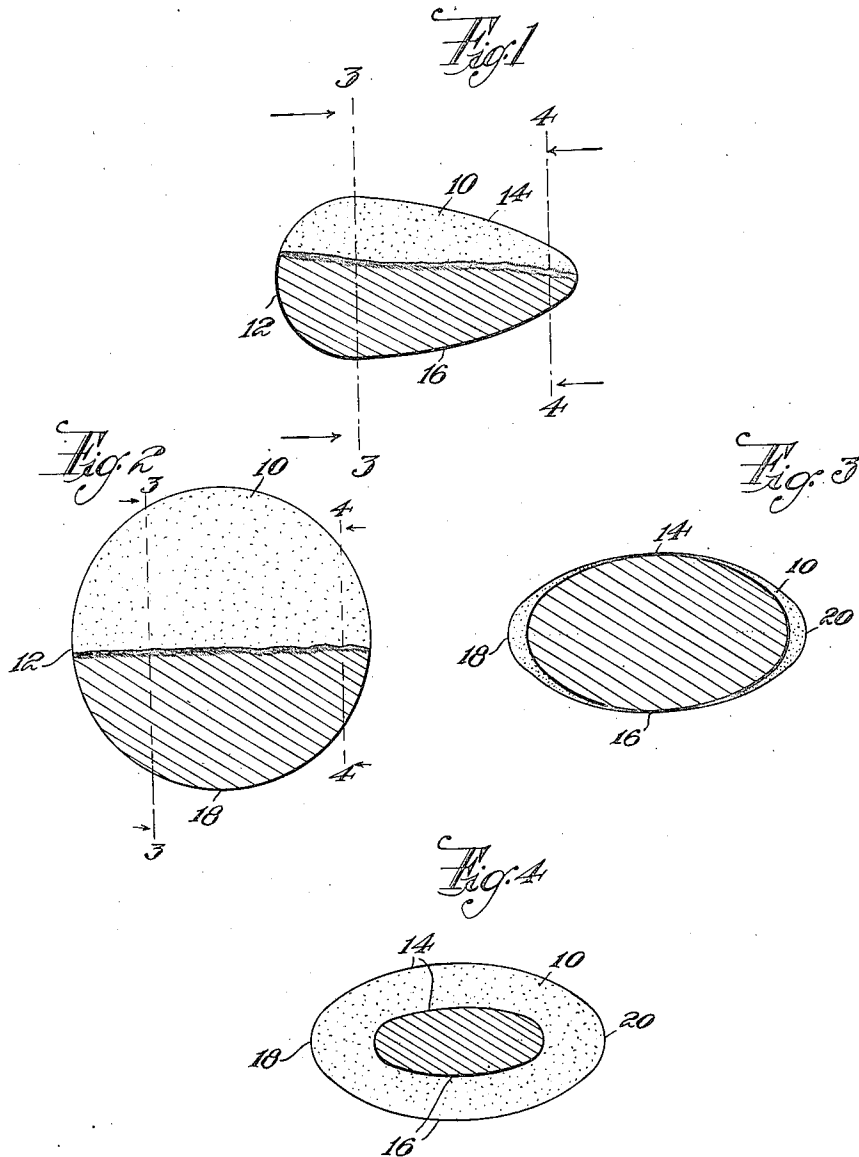
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A. FEUST

TRITURATING MEMBER

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INVENTOR  
*Arthur Feust*  
BY *C. P. Goepel*  
ATTORNEY

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# UNITED STATES PATENT OFFICE.

ARTHUR FEUST, OF NEW YORK, N. Y.

TRITURATING MEMBER.

Application filed January 17, 1922. Serial No. 529,367.

*To all whom it may concern:*

Be it known that I, ARTHUR FEUST, a citizen of the United States, and resident of the borough of Manhattan, city, and State of New York, have invented a certain new and useful Triturating Member, of which the following is a specification.

This invention relates to grinding mill balls, and to mills of the ball and drum type.

An object of the invention is to provide a novel tritulating member for such mills to take the place of the balls heretofore used. In the operation of such mills with round balls, the material is always left in relatively large particles largely because only a grinding action takes place, and when such materials are ground to the greatest practicable fineness in mills containing round balls, they invariably feel gritty. With the use of this invention, rock materials may be pulverized so finely as to feel smooth to the touch. In other words, the present invention operates with a tritulating action as distinguished from the rolling action of mills of the ball and drum type as heretofore employed.

Another object of the invention is to provide tritulating members or elements which themselves wear uniformly in consonance with their original shape so as to retain substantially their original shape after long continued use, and thus throughout their life operate and function under the same fundamental laws governing their original shape.

It has also heretofore been proposed to employ grinding elements other than round balls in mills of the ball and drum type in the hope of adding to their grinding action a tritulating action and thus breaking up the material so that it will pass through a fine mesh. For instance, it has been proposed to use pebbles of irregular shapes, oblong rectangular blocks having plane sides, and lenticular disk-shaped and ovaloid grinding devices. None of these devices, however, operates continually with a tritulating action, and their object was therefore frustrated. Moreover, such devices, as heretofore proposed, have the serious objection that they do not wear uniformly consonant with their original shape in consequence of which the character and extent of their grinding action varies greatly with the length of their use. For the above and

other reasons, none of such modified forms of grinding elements has gone into general use, so far as applicant is aware.

An important feature of the invention resides in the provision of a tritulating element adapted for use in a mill of the ball and drum type and having a substantially circular basic configuration with substantially paraboloidal and ellipsoidal sections perpendicular to each other and to the basic circular section so as to provide oppositely disposed tritulating surfaces. In defining the invention in terms of substantially circular, substantially paraboloidal and substantially ellipsoidal dimensions, I do so with the understanding that I am not confined to geometrical exactitude, as I use such terms to portray the functional law inherent in such configuration.

Other objects and features of the invention will appear as the description proceeds and will be pointed out in the appended claims.

In the drawings:

Fig. 1 is a view in side elevation of the improved tritulating element and showing the lower portion of the element in section;

Fig. 2 is a plan view of the element, showing the element in section in the lower part of the figure;

Fig. 3 is a view in vertical transverse section along the line 3—3 of Figs. 1 and 2; and

Fig. 4 is a view in section along the line 4—4 of Figs. 1 and 2 and looking in the direction of the arrows.

Similar reference characters indicate similar parts in the several views.

As illustrated in the drawing, the basic dimension of the tritulating element 10 is circular. In planes at right angles to the basic circular dimension or main section of the element, which is in the plane of a horizontal line drawn through the middle of Fig. 1, the sections in one direction through the element are paraboloidal, and in planes at right angles thereto are ellipsoidal. The general exterior configuration of the element resembles very closely the exterior configuration of a sea clam excepting that the sharpened edges of the mouth are rounded off. As the clam has its centroid off center, so the new tritulating element has its centroid off center, that is, its center of volume or gravity is off center with respect to its center of figure. In general also the move-

ment of the element down an inclined plane closely resembles that of a clam. In the drawing the end surface at the base of the element is designated by 12, and its upper and lower surfaces by the numerals 14 and 16. Although the surfaces 14 and 16 do not lie in a plane but are slightly curved longitudinally, as clearly appears from Figures 1 and 4, they may be said to be flattened with respect to the other surfaces of the element, since the degree of their curvature is very small compared with the curvature of the base portion 12 and the circular section of the element.

The surfaces 14 and 16, as will be seen by reference to Figures 2, 5, 6 and 7, are also slightly curved in sections transverse to the element as well as in longitudinal sections, the surfaces 14 and 16 of relatively slight curvature being interposed between edge surfaces 18 and 20 of relatively sharp curvature. The entire surface of the element is uninterruptedly curved, the portions of the surface of varying curvatures merging into each other without any definite line of demarcation.

When a number of triturating elements constructed in accordance with this invention are contained in a rotating drum, their surfaces 14 and 16 of relatively slight curvature prevent them from rolling over each other after the manner of round balls and instead thereof cause them to have a sliding movement one upon another. In addition to and simultaneous with their sliding movements, the triturating elements also undergo relative turning or twisting movements, such relative turning movements combined with their sliding movements causing them to act with a triturating effect on the material being ground.

It will be apparent from the foregoing that the triturating elements are considerably heavier at one of their ends than at the other, which follows because their centroids are off center, the elements being in equilibrium on a downwardly inclined surface only when their heavier ends are lowermost. The movement of the drum and the forces exerted on the elements by each other and by the material being ground cause them to be off-balance almost, if not quite, continuously during the operation of the mill. Whenever an element is thrown into an unbalanced position, it tends to recover its equilibrium. If an element is not subjected to other forces during its return to balanced position, it will move somewhat after the manner of a pendulum or a clam on an inclined surface. In other words, the heavier end of the element will swing first to one side and then to the other.

The very considerable and practically continuous turning movements of the elements of this invention, which result from their

being thrown out of a position of equilibrium and tending to return to such position, is very important in causing them to act with a triturating effect on the material being ground. The triturating action of the elements is also enhanced by the fact that when the slightly curved surface 14 or 16 of one of them is in contact with the surface 14 or 16 of the adjacent element, the surfaces of the elements diverge very gradually from their contact point. Such arrangement of the surfaces not only provides a large active zone, but a zone in which the intimate association of the surfaces causes a triturating action even on particles which are very small, so that they are broken up or pulverized into yet smaller particles.

In the use of grinding mills containing round balls, the surfaces of the adjacent balls diverge abruptly from their contact point, even when comparatively large balls are employed. Accordingly, the zone of grinding action between any two of the balls is very limited and no grinding action is exerted on a small particle between the balls unless such particle happens to be practically at the contact point. Moreover, inasmuch as the contacting surfaces of two round balls are substantially similar, the balls are likely to assume a condition of equilibrium with respect to each other in which they have little or no tendency to slide one upon the other. In the use of a grinding mill containing the elements of the present invention, adjacent elements will generally contact with each other at the slightly curved surfaces 14 and 16. In the event, however, that one of the more sharply curved portions of one of the elements contacts with the surface 14 or 16 of the adjacent element, the active zone between the two elements will be much larger than if the elements were constructed in the form of round balls. Furthermore, the first-mentioned element will tend to slide upon the slightly curved surface of the second element, thereby bringing the slightly curved surfaces of the elements into substantial contact and producing thereby a triturating action.

The elements having their main or longitudinal sections circular and having tapering surfaces such as have been hereinbefore described will wear uniformly in consonance with their original shape and will consequently retain substantially their original shape even after long continued use. As a result of this, the functioning of the elements will be the same throughout the life of the elements. When, however, other forms of elements having tapered surfaces but not having their main sections circular were tried out, it was found that they did not wear uniformly.

This invention is particularly applicable

in cases where it is desired to reduce an ore from 100 to 200 mesh or finer.

I have described the elements in terms of circular, paraboloidal and ellipsoidal configuration. I have done this to portray the preferred embodiment with accuracy to enable those skilled in the art to construct elements in accordance with my invention. It is, of course, clear that an element having such configuration will function in accordance with certain definite laws and that a principle of the invention is readily perceived therefrom. By using the word substantially as definitive of these configurations, I desire to include all such elements that operate within said principle of the invention, as otherwise a geometrical limitation would not fully protect my invention, and so desire it to be understood that I contemplate within such definitive terms a reasonable equivalence.

Having fully described the invention, what is claimed is:

1. A tumbling element for tube mills, said element being substantially disk-shaped in plan and having a rounded peripheral edge and decreasing in thickness along curved lines from a point on one side of the center of the plan thereof to all points at its peripheral edge.

2. A tumbling element for tube mills, said element being substantially disk-

shaped in plan and having a rounded peripheral edge and decreasing in thickness along curved lines from a point on one side of the center of the plan thereof to all points at its peripheral edge, and having its centroid off center.

3. A tumbling element for tube mills, said element being substantially disk-shaped in plan and having a rounded peripheral edge and decreasing in thickness along curved lines from a point on one side of the center of the plan thereof to all points at its peripheral edge, and having a substantially paraboloidal section extending from end to end of the element and being substantially ellipsoidal in sections transversely of the element so as to present oppositely disposed triturating surfaces.

4. A tumbling element for tube mills, said element being substantially disk-shaped in plan and having a rounded peripheral edge and decreasing in thickness along curved lines from a point on one side of the center of the plan thereof to all points at its peripheral edge, and having uninterrupted, merging curved surfaces, and the element being substantially paraboloidal and ellipsoidal respectively in sections at right angles to the plan and to each other.

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

ARTHUR FEUST.