June 2, 1953 G. C. YEHLING, JR 2,640,226

ATTRITOR FOR FIBROUS MATERIAL

Filed April 19, 1950

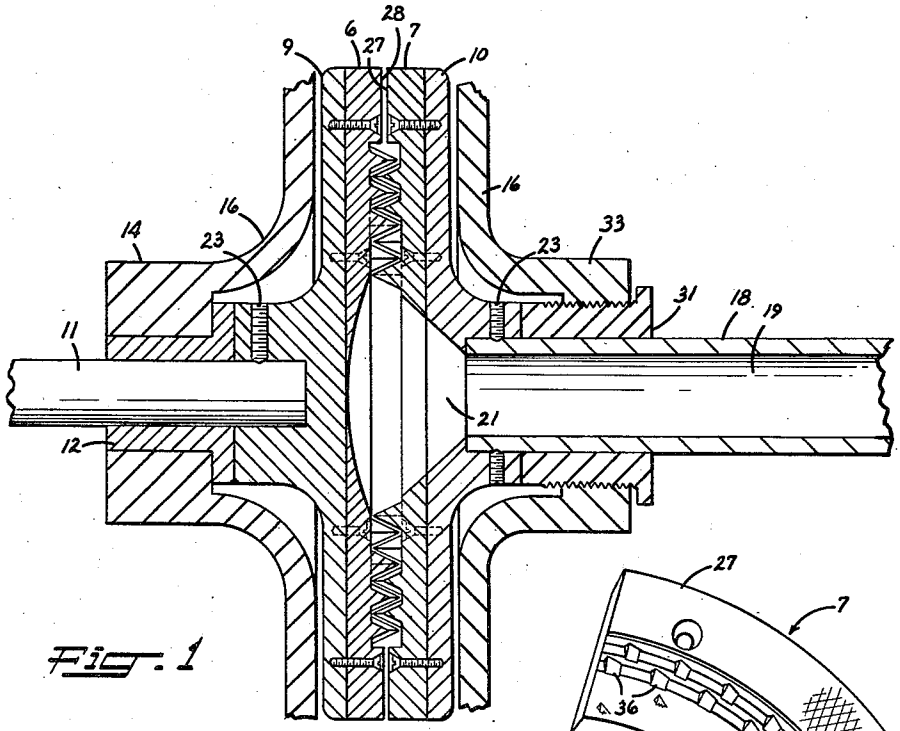
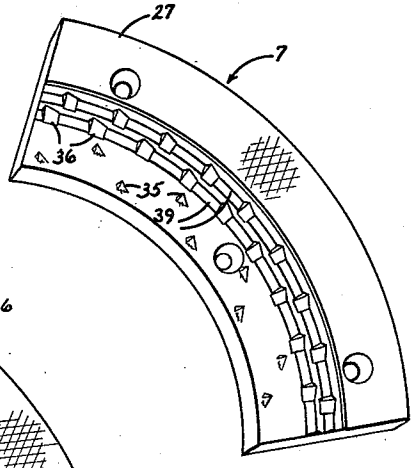


Fig. 1



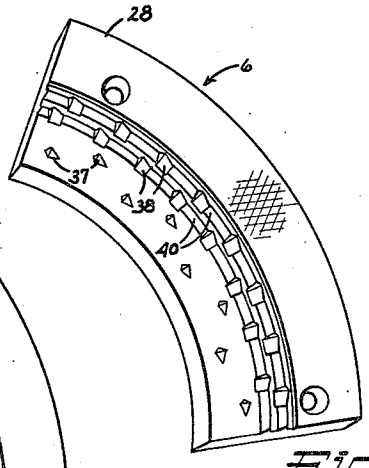


Fig. 2

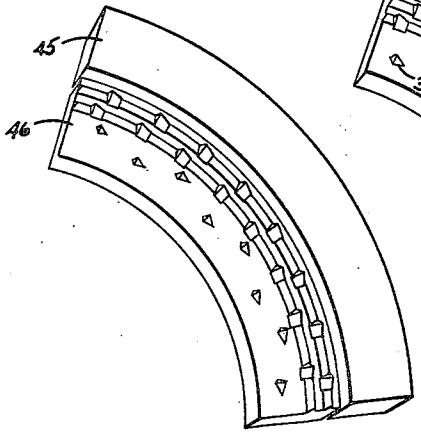


Fig. 3

Fig. 4

INVENTOR.
GEORGE C. YEHLING, JR.
BY
Thomas B. Kelly
ATTORNEY.

Patented June 2, 1953

2,640,226

UNITED STATES PATENT OFFICE

2,640,226

ATTRITOR FOR FIBROUS MATERIAL

George C. Yehling, Jr., St. Louis, Mo., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

Application April 19, 1950, Serial No. 156,923

4 Claims. (Cl. 18—1)

1

This invention relates to attrition mills and particularly to mills for comminuting fibrous materials into a highly divided particulate state.

An object of the present invention is to provide an attritor for fibrous material such as the alkali cellulose fiber which is produced as an intermediate product in the manufacturing of regenerated cellulose products, which will disintegrate the fibrous material while avoiding the producing and dispersing of light fluffy fibrous material within the vicinity of the attritor. It is another object to transform a fibrous alkali cellulose material into a loosely textured pelletized mass which is readily penetrated by carbon disulfide. Other objects, features and advantages will be apparent from the following description and the drawing relating thereto in which

Fig. 1 is a section taken along the axis of an attritor provided with attrition plates according to the invention;

Fig. 2 is a pictorial view of a section of an attrition plate included in the apparatus shown in Fig. 1;

Fig. 3 is a pictorial view of a section of the attrition plate of Fig. 1 opposite that shown in Fig. 2; and

Fig. 4 illustrates pictorially an attritor element which may be substituted for an attritor plate such as shown in Figs. 2 and 3.

In brief, the invention comprises annular comminuting pellet-forming plates which may be mounted in opposed relationship on relatively rotatable members. The facing surfaces of the plates are formed in a manner first to roughly shred material which moves radially outwardly from a feed region between inner annular toothed sections of both surfaces from which the teeth extend in axially overlapping relationship. The material is carried into the clearance between another outer concentric pair of annular sections each section comprising a plurality of ridges and teeth extending therefrom in alternate radial spacing with the ridges and teeth of the opposite section to be subjected to further shredding action. The material then passes radially outwardly between a pair of opposed substantially flat surfaces which roll or form small aggregates of the material in pellets or balls.

Fig. 1 illustrates in section an attritor provided with annular plate members 6 and 7. The members 6 and 7 are secured to annular coaxial support members 9 and 10 respectively. The member 9 is secured to a solid shaft 11 extending through a bearing 12 mounted in a hub 14 of an attritor housing 16. The shaft 11 is driven

2

by a means not shown. The attrition plate 7 is secured coaxially to the member 10 which is supported on a tubular shaft 18 of which the bore 19 thereof is contiguous with the aperture 21 of the member 10. Members 9 and 10 may be secured to their respective shafts by set screws 23. The shaft 18 may be rotated from a driving means not shown. Usually the shafts 11 and 18 will be rotated in opposite directions. However, either shaft may be held stationary while the other is rotated at a sufficient speed to obtain the desired relative movement between the members 6 and 7, or the stationary plate may be fixed to the inner wall of the housing 16, if desired.

The toothed surfaces of the members 6 and 7 are precision formed to the degree that the opposing toothed surfaces of the members may be revolved at a clearance within 0.0001 of an inch. A greater clearance, preferably under 0.02 to 0.03 of an inch, may be maintained between the surfaces 27 and 28 so that the material passing through the attritor will be rolled or otherwise formed into small pellets before passing from the working space between the members. The surfaces 27 and 28 are relatively flat and smooth to avoid substantial shearing action of the material passing therebetween from the shredding surfaces. Pellet-forming by these surfaces is promoted somewhat if they are criss-crossed by very small grooves to form the grid pattern illustrated in Figs. 2 and 3. However, fine radial grooves, or other groove patterns may be substituted for the grid pattern illustrated. If desired, the surfaces may be prepared in a manner such that the clearance therebetween diminishes as the diameter thereof increases. Pelletizing surfaces between which the clearance region diminishes in this manner may be straight or slightly convex in cross-sectional contour. To adjust the clearance between the members an exteriorly threaded element 31, which functions as a sleeve and thrust bearing, extends in threaded relationship with the hub 33 of the casing 16.

Figs. 2 and 3 illustrate segments of the opposing attrition members shown in Fig. 1. The shredding elements of both members comprising the teeth 35, 36, 37 and 38 are arranged in accurately spaced concentric rows which permit operating the attrition members at close clearance. The rows on each member are spaced and the teeth are shaped so that a circular row of teeth on one member will be accurately centered between and will pass between the rows of teeth on the other member when brought into close

clearance therewith. The annular ridges 39 and 40 from which the teeth 36 and 38 project also extend between each other when the plates are brought into close proximity. These ridges restrain the movement of material through the shredding region traversed by the closely spaced teeth 36 and 38 so as to prolong the contact of the material with these teeth and thus to increase the degree of attrition. As the material passes from the region traversed by the teeth 36 and 38, it is rolled into pellets or balls between grid surfaces 27 and 28 of the members 6 and 7. The size of the pellets will depend on the clearance maintained between the surfaces 27 and 28. The members 6 and 7 may comprise a number of segmental elements such as shown in Figs. 2 and 3 or may be provided in the form of a unitary annular member.

In the event it is desired to vary the clearance between the surfaces corresponding to surfaces 27 and 28, such surfaces may be provided on separately mounted elements such as element 45 shown in Fig. 4. Elements of different thicknesses may be provided to obtain different clearances between opposing grid sections. An element similar to element 46 may be substituted for the untoothed sections of the members 6 and 7.

Attrition plates according to this invention are rotated at sufficient speed to produce impact of the teeth with the material passing therebetween which shears the material. Such speeds range normally from 1000 to several thousand feet per minute linear velocity of the comminuting area of one plate with respect to the opposing area of the other plate. For example, in an attritor having plates which have an inner diameter of 6 inches and an outer diameter of 12 inches, the plates may be rotated relative to each other at speeds of 1000 or more revolutions per minute for effective comminution and pelletization of alkali cellulose fiber.

While preferred embodiments of the invention have been shown and described, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A rotary attritor comprising annular attrition members axially spaced to provide a working space therebetween, each of said members having concentric radially spaced annular working zones comprising annular rows of pyramidal teeth in a radially inner zone of each member extending into the working space, annular rows of pyramidal teeth extending from intervening concentric arcuate ridges in a radially intermediate zone of each member, the rows on one member being disposed in alternation with the rows on the other with close clearance therebetween in both the inner and intermediate zones, and annular relatively flat and smooth pellet-forming surfaces in a radially outer zone of each member spaced at a predetermined clearance, said pellet-forming surfaces having more clearance than the teeth to facilitate the formation of pellets.

2. An attritor as defined in claim 1 in which the pellet-forming surfaces are provided with fine grooves.

3. An attritor as defined in claim 1 in which the pellet-forming surfaces are provided with fine grooves forming a criss-crossed grid.

4. An attritor for fibrous alkali cellulose comprising two opposed coaxial rotatable members, one of said members having a central opening, means for introducing the fibrous material through the opening, concentric rows of spaced pyramidal teeth along an annular portion of each member extending into axially overlapping relationship with the rows of the other member and spaced to produce small clearance therebetween when one member rotates relatively with respect to the other member, a plurality of circular ridges extending from the surfaces of each member along a portion exteriorly concentric with respect to the annular toothed portion, pyramidal teeth projecting from the ridges toward the opposing members into the annular spaces between the ridges and the teeth extending from the ridges of the opposing plate, said ridges of the opposing members extending into overlapping relationship, and outer annular flat surfaces in opposing relationship on each member, and spaced to produce pellets of a desired thickness.

GEORGE C. YEHLING, JR.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
Re. 16,191	Povey et al.	Oct. 27, 1925
2,226,429	Hall	Dec. 24, 1940
2,232,444	Frenkel	Feb. 18, 1941