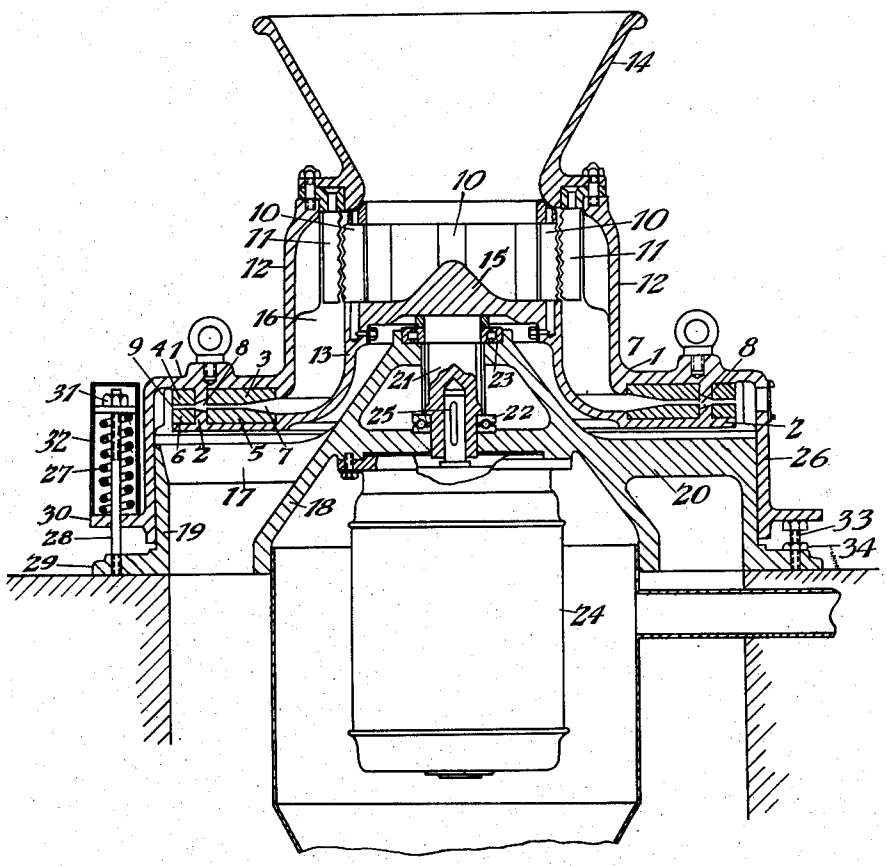
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APPARATUS FOR SHREDDING ALKALI CELLULOSE OR LIKE FIBROUS MATERIALS

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APPARATUS FOR SHREDDING ALKALI CELLULOSE OR LIKE FIBROUS MATERIALS

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1 Claim. (Cl. 83—7)

This invention relates to apparatus for shredding fibrous materials of various kinds, particularly alkali cellulose, and has for its object the provision of an improved disk mill of the kind in which the material is fed outwardly between co-operating annular or disk-shaped relatively rotating shredding elements. Disk mills are of course well known, but, as built heretofore they have been unsatisfactory for the shredding of alkali cellulose or similar fibrous vegetable or mineral materials. In the disk mills previously used for shredding cellulose, hooked beater arms have been provided to feed the material radially outward into the annular inlet opening between the relatively rotating shredding elements. This positive feed, plus centrifugal force, has resulted in an occasional oversupply of cellulose to the milling disks, alternating with an undersupply. When this happened the excess of material between the disks would overheat, and the material fed unevenly would not be uniformly shredded. Furthermore, these earlier conventional disk mills would often pack and twist large pieces of the fibrous material into dense rolls between the disks instead of separating its fibres.

The object of this invention is to overcome the disadvantages of previous disk-type mills by providing a co-operative pre-tearing device in which the raw material is broken into small pieces of uniform size suitable for treatment between the shredding disks. As a further feature of the invention, material from the pre-tearing elements is discharged through an expansion chamber or transitional passage leading to the shredding disks, through which the torn material falls inertly instead of being fed forcibly by centrifugal force. In this transition passage more or less torn cellulose may be accumulated, so that it acts as an equalizing compartment which maintains a uniform supply to the shredding elements of the apparatus in spite of minor variations in the feed of material to the apparatus. Over and underfeeding are thus avoided.

A preferred apparatus embodying the invention is described in the following specification and is illustrated in the accompanying drawing, which shows in vertical cross-section a tearing and shredding mill according to the invention.

Upper and lower grinding elements 1, 2 are opposed in a substantially horizontal plane. Upper element 1 carries an inner shredding ring 3 and an outer annular shredding element 4, in the same approximate plane as element 3 and spaced radially therefrom. Upper element 1 in the present machine is the stator of the mill. The corresponding lower element 2 is rotating and is provided with annular radially spaced shredding elements 5 and 6 opposing and co-operating with elements 3 and 4 respectively of the rotor 1. The working surfaces of shredding elements 3, 6 are serrated or toothed in known manner to effectively engage and separate the particular fibres being treated. The pairs of opposed shredding rings are spaced apart and are provided with inclined working surfaces to define tapered shredding spaces between them. Between the inner rings 3 and 5 a tapered entrance space 7 is provided for the inducement and initial shredding of the alkali cellulose. The induced material is drawn between the more closely adjacent working faces of rings 3 and 5, for shredding to a moderate fineness, determined by the nature of the material and the spacing of the rings. At the outer edges of elements 3 and 5 a tapered expansion space is provided to receive the material discharged from between them in which it is pulled and whirled to a fluffed condition, after which then it is drawn between the second pair of rings 4 and 6. The working faces of shredding elements 4 and 6 are spaced closer together than the first pair to reduce the cellulose particles to the desired degree of fineness for xanthating or other processing.

The machine illustrated embodies also a pre-tearing stage for the pieces or chips of alkali cellulose. By combining the pre-tearing and the shredding stages in the novel relationship found in the instant machine, one apparatus is made available for preparing the alkali cellulose for xanthating or other subsequent steps in the production of the desired product. The pre-tearing apparatus consists of upstanding toothed rods 10 fixed upon and revolving with the rotor 2. Co-operating stationary toothed tools 11 surrounding tools 10 depend vertically from a housing 12, which also carries the upper shredding element 1. Tools 10 and 11 are arranged cage-like in concentric circles, so that the revolving tools 10 pass the stationary tools 11 with a desired clearance. The rotor 2 has an upwardly tapered or dished hub 13 provided with a cone-shaped cap 15. A hopper 14 mounted on the housing 12 feeds a supply of material onto the conical hub cap 15. The cone-shaped cap deflects and throws the material outwardly by centrifugal force into the rapidly revolving rods 10, where it is torn between the relatively moving opposed toothed surfaces of tools 10 and 11. The centrifugal force which impels the material between rods 10 is dissipated by the engagement with the stationary

rods 11 and the wall of housing 12 so that the pre-torn cellulose falls into an annular chamber 16 with little or no tangential velocity. Annular chamber 16 leads substantially vertically downward and then laterally with a gradual narrowing into the tapered entrance space or slot 7 between the first shredding rings 3 and 5. There is no forcing-in of the material by the pre-tearing tools, or any beater elements adjacent the first shredding zone such as have heretofore been employed in apparatus of this kind. Only that material which rests in the outwardly directed bottom portion of the passage 16 is acted upon by centrifugal force, and since this quantity remains constant, there is a uniform feeding effect urging the material into the tapered entrance slot 7.

In the first annular shredding zone the material is initially shredded to a medium-coarse condition. The radial width of this zone is proportioned to the space between the elements 3 and 5, so that the material is discharged before it has a tendency to roll or pack to any detrimental extent. It is thrown into the expansion chamber 8 wherein any packed rolls of cellulose are broken up and whirled into a loose fluffy condition. It is then drawn by centrifugal force into the shredding space 9, between rings 4 and 6, which further reduce the particles to the desired degree of fineness. It is preferable that space 8 be tapered or wedge-shaped in cross-section, as shown, in order that the material may be gradually drawn into the intake edge of the annular space 9 of the second shredding zone.

At the periphery of the two elements 1 and 2 the finely shredded cellulose is discharged by centrifugal force, whence it falls through a plurality of discharge openings 17 in the machine base. The machine base consists of a substantially conical center piece 18 which serves also as a motor cover. An outer circular side wall 19 spaced from the conical base 18 is connected thereto by a plurality of radial ribs 20, which define the discharge openings 17. The rotor element 2 is rotatably carried upon the machine base 18 upon a centrally journaled vertical stub shaft 21. Shaft 21 is journaled in suitable bearings, such as a thrust bearing 22 and a radial roller bearing 23 mounted in the base 18. A motor 24 is connected through its motor shaft 25 directly to the stub shaft 21.

Housing 12 has a downwardly depending cylindrical skirt which fits slidably over the outer cylindrical wall 19 to enclose all of the working parts of the machine. The entire upper assembly, including the stationary shredding element 1, is adjustably and resiliently mounted relative to the base 19 and rotor 2. In the machine shown a plurality of spring hold-down assemblies are provided about the base of skirt 26. Each consists of a spring 27 upon a stationary bolt 28, screwed into a flange 29 at the base of the outer wall 19. Bolts 28 pass upward through openings in a flange 30, integral with the skirt 26 of housing 12. A nut 31 is provided upon screw 28 for adjustably compressing the spring 27 so that the housings 12 and 19 and the upper assembly may yield upwardly if any solid foreign matter should come between the shredding rings. A dust cap or housing 32 is provided for each yieldable mounting.

To adjust the working clearance between the shredding elements 1 and 2, adjustable supports for skirt 19 and housing 12 are provided in the flange 30. For example, set screws 33 are screwed at regular intervals into the flange 29 and are provided with lock-nuts 34 to secure the skirt 26 at any desired height.

While a preferred embodiment of my invention has been shown and described, various modifications may be made without departing from the scope of the appended claim.

One or more subsequent shredding stages of any desired known kind different from those shown herein may be employed in apparatus according to the invention. In certain processes and with certain materials it will be found that a single shredding stage will reduce the material to a desired degree of fineness, provided the material is pre-torn effectively and supplied to the shredding stage at a uniform rate, as is accomplished by the apparatus of this invention.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

A mill for shredding alkali cellulose or similar light fibrous material comprising in combination a machine base, a power-driven vertical stub-shaft journaled in said base, a rotor comprising a smooth-surfaced hub of substantial height concentrically mounted upon said stub-shaft, an annular shredding element presenting an upwardly directed annular working face mounted adjacent the periphery of said rotor, a housing for said rotor mounted upon said machine base, an annular shredding element in said housing cooperatively opposing the working face of the shredding element on said rotor and defining therewith a radially directed shredding slot, pre-tearing apparatus positioned above the plane of said shredding element comprising upstanding tools spaced in a circle upon the end of said hub, and cooperative concentrically arranged stationary tools mounted upon said housing exteriorly of the tools on said rotor, said hub above said shredding slot being diametrically smaller than the circle of said stationary tearing tools and defining with said housing a substantially vertical annular passage of substantial capacity which at its upper extremity surrounds the circle of the pre-tearing tools to receive material discharged therefrom and leads directly downward to the entrance of said shredding slot, said annular passage serving as a reservoir for material discharged from said pre-tearing apparatus to equalize the flow of material and deliver it to the entrance of said shredding slot by gravity alone, and means for feeding material within the circle of tearing tools on said rotor.

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