APPARATUS FOR SHREDDING FIBERS AND FABRICS

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ABSTRACT OF THE DISCLOSURE

The fabric to be shredded is acted upon by the teeth of a shredding cylinder while engaged by a breaker bar located between the cylinder and a toothed feed roll which is rotatable in a direction opposite to that of the shredding cylinder. A first garnett roll is located adjacent the shredding cylinder but remote from the feed roll and is rotatable in a direction opposite to that of the shredding cylinder, there being an intermediate breaker bar to engage fabric from the shredding cylinder while this partially shredded fabric is further shredded by the garnett points of the first garnett roll. To effect final shredding, a second garnett roll is located adjacent the first one, the two garnett rolls being rotatable in opposite directions at differential speeds.

An air blast is directed at the final shredding zone to remove the shredded fabric.

This invention relates to an improved mechanism for shredding and opening various textile fabrics into separate fibers.

The material to be shredded by such apparatus may be of various kinds, such as woven, nonwoven or knitted fabrics, or fibrous material such as jute butts, bagasse and other fibrous materials which must be processed through a shredding operation to make them commercially usable as fibers.

The term "fibers" as used herein refers to woven materials, knit materials, braided materials, nonwoven fabrics, or combinations of such materials however formed of textile fibers.

The stock from the shredding apparatus is usually processed through subsequent carding steps so as to align the fibers in order to produce yarn or various types of batting. The degree of shredding accomplished in the initial operation substantially affects the cost of maintaining the cards and also affects the quality of the finished material. It is important that the material be shredded with a minimum of fiber breakage to preserve fiber length and that the quantity of unshredded stock be held to a minimum.

Mechanisms for shredding, picking, or opening these various materials are in common use but all unfortunately allow the passage of unshredded or partially shredded or opened stock along with the separated fibers and such imperfectly shredded material imposes an objectionable load on the succeeding processing machinery. A further disadvantage of existing machinery lies in the difficulty of adjusting the machinery quickly so as to handle effectively various grades or types of material.

An important objective of the present invention is to provide a mechanism capable of greatly diminishing or eliminating the incidence of the unshredded or partially shredded stock.

A second objective of the invention is to provide a means whereby the operator can quickly and easily make adjustments for various qualities of raw material.

A third objective is to provide a means for shredding various materials without causing excessive damage to the fiber being processed.

The above and other objects and advantages of the invention will become more apparent and understood from consideration of the following detailed description with reference to the accompanying drawings in which:

FIGURE 1 is a schematic elevation of a shredding machine made in accordance with this invention;

FIGURE 2 is a fragmentary isometric view of the feed roll and a first breaker bar for heavy fabrics;

FIGURE 3 is an enlarged elevational view of the feed roll and breaker bar as they cooperate with the shredding cylinder.

FIGURE 4 is a fragmentary isometric view of the feed roll and breaker bar for light fabrics;

FIGURE 5 is an enlarged elevational view of the arrangement of the breaker bars between the shredding cylinder and the first garnett roll;

FIGURE 6 is an enlarged elevational view of the garnett rolls;

FIGURES 7 and 8 are schematic views showing the drive for the various elements of the machine in accordance with the invention.

In FIGURE 1, the conveyor 11 transmits fabric to the feed roll 12 which has peripheral teeth 6. The first breaker bar 13 has a breaker bar blade 14. The shredding cylinder 15 has shredder teeth 21. The lower intermediate breaker bar 16 and the upper intermediate breaker bar 17 are located between the shredding cylinder 15 and the first garnett roll 18. The second garnett roll 19 is nearly tangent to the first 18. The air exhausting duct 20 and the air blast injector 5 remove the shredded product from the garnett rolls 18 and 19. As shown by the arrows in FIG. 1, the feed roll 12, shredding cylinder 15 and first garnett roll 18 rotate in the same direction (counter-clockwise), while the second garnett roll 19 rotates in the opposite direction (clockwise).

FIGURE 2 shows a type of feed roll having teeth 6 as used for heavy fabrics such as jute bagging, carpeting, etc.

FIGURE 3 shows the feed roll 12 with a piece of fabric 24 as it is shredded.

FIGURE 4 shows a feed roll having fine teeth or points 6' as used for garment clips, waste yarn, fiber waste and light materials.

FIGURE 5 illustrates the relationship between the shredding cylinder 15 and the first garnett roll 18 as well as the intermediate breaker bar 16 and 17. The shredder teeth 21 on the shredding cylinder cooperate with the breaker bar blade 22 in the intermediate breaker bar 17. Garnett wire 23 encircles the first garnett roll 18.

Garnett points 23 cooperate with blade 22 of the second intermediate breaker bar 16.

FIGURE 6 illustrates the relationship between the garnett rolls 18 and 19. Garnett wire 23 encircles the first roll 18 and garnett wire 31 encircles the second 19. This view illustrates also the direction of rotation of these two garnett rolls.

FIGURE 7 represents the drives for the various moving elements. A motor 41 drives the conveyor 11 and feed roll 12. This may be a variable speed or fixed speed motor.

The drive is from motor 41 through a motor sprocket 42 and chain 43 to a clutch sprocket 44. This clutch
sprocket turns another driven sprocket 45 and chain 46 and thus drives sprocket 47. This sprocket 47 drives a gear 48 which meshes with and drives gear 49 that drives the conveyor 11.

The sprocket 50 which drives the feed roll 12 is also driven from the clutch through a chain 51 from a sprocket hidden from view behind the clutch sprocket 44.

FIGURE 8 shows the main drive motor 52 which drives through a V-belt pulley 53. V-belts 54 and 63 drive V-belt pulley 55 with double grooves and V-belt pulley 56 on shredding cylinder 15 and first garnet roll 18 respectively. An idler pulley 57 takes a slack. The motor drive 58 for the second garnet roll 19 is a variable speed unit and drives through a motor pulley 59 on the motor shaft, a V-belt 60, and the driven pulley 61 on the second garnet roll. The variable speed control handle 62 is mounted for convenient adjustment by the operator.

OPERATION OF THE SHREDING MACHINE

Referring first to FIGURE 1, the material to be opened, picked, or shredded, is deposited upon the conveyor 11 either by hand or by a mechanical feeder which feeds the material uniformly over the surface of the conveyor. The conveyor may be arranged to run continuously or may be intermittently controlled by the operator as the requirements for stock dictate.

The material thus deposited upon the conveyor 11 is transferred to the feed roll 12 by means of feed roll teeth 6. The feed roll 12 normally is operated at a surface speed fractionally higher than the lineal conveyor speed. The stock is advanced to the breaker bar 13 where-in it is acted upon by the rapidly moving shredder teeth 21 of the shredding cylinder 15. The surface speed of the shredder teeth 21 is much faster than the surface speed of the feed roll 12 and the stock is restrained by action of the feed roll. As the fabric advances the end of the fabric is released by the feed roll and the fabric is snatched by the teeth of the shredding cylinder 15. This end is therefore not opened or picked. This condition is illustrated in FIGURE 3.

The spacing of the cylinder 15 with respect to the second breaker bar 13 is adjustable. Generally speaking, the closer this spacing, the higher the degree of shredding. Output quantity also varies directly with the spacing.

The stock is carried around the bottom half of the shredding cylinder to the upper intermediate breaker bar 17 which provides a partial shredding place. This breaker bar 17 is also adjustable with respect to the surface of the shredding cylinder 15, and the degree of shredding taking place at this point is controlled by this spacing.

The partially shredded stock and occasional unshredded ends are transferred to the first garnet roll 18 in the vicinity of breaker bar 17 and is carried downward by the points of the garnet wire 23 as is shown in FIGURE 4. The stock is then further shredded by the lower intermediate breaker bar 16 whose position with respect to the first garnet roll 18 is adjustable.

The stock is carried around the bottom half of the first garnet roll 18 by the garnet wire 23 to a point where the garnet rolls 18 and 19 are most nearly tangent. The spacing between these two rolls is adjustable. The points of the garnet wire 23 on the first garnet roll 18 point upward and are moving upward at this point of near tangency. The points of the garnet wire 19 point downward but are moving upward at this point. The surface speed of the first garnet roll 18 is fixed while the surface speed of the second garnet roll 19 is variable over a considerable range. Since the two rolls operate with a small clearance between their garnet wire points, and since all the stock must pass between the two, no particle larger than the spacing between the rolls can go through without being shredded by the differential speeds of these rolls. The amount of final shredding taking place at this point varies as the speed differential between the garnet rolls. As the speed of the second garnet roll approaches that of the first, less shredding will occur at this point.

In actual practice in shredding jute bagging, for example, the quality of the raw material will vary from bale to bale or even within a bale. Some will be tightly woven bagging with yarn highly twisted. Others will be loosely woven with little twist in the yarn. If a conventional shredder is adjusted for the tightly woven material it will overshred the soft material causing excessive fiber shortening. With the variable speed control for the second garnet roll of our invention, it is possible for the operator to make immediate adjustment for the type of raw material encountered.

An air blast consisting of a pipe 5 with numerous small holes prevents small fibers of fabrics from lodging between successives turns of the garnet wires, and moves these fibers to the points of the wires where it can be acted upon by the garnet wire points of the other roll. By means of the several adjustments of the positions of the breaker bars it is possible to control the amount of shredding at these shredding points and thus control the proportion of shredding to be accomplished by the shredding cylinder and the garnet rolls. The shredding action between the garnet roll is less harsh than at the breaker bars and there is consequently less fiber shortening.

The shredded fiber is extracted from the space between the garnet rolls by means of a vacuum in the duct 20 created by a fan (not shown).

The apparatus of our invention results in three successively finer shredding actions as the material passes between the various rolls and permits simple and rapid control over the shredding action.

It will be apparent that many modifications may be made within the scope and spirit of our invention and, accordingly, we do not wish to be limited otherwise than as indicated by the terms of the appended claims.

We claim:

1. Apparatus for shredding fabric and the like which comprises: a rotatable feed roll having peripheral teeth for engaging and feeding fabric to be shredded, a shredding cylinder having peripheral shredding teeth, said shredding cylinder being rotatable in the same direction as that of said feed roll, a breaker bar between said roll and said cylinder to engage the fabric fed by said roll while the fabric is acted upon by the shredding teeth, a feed rolls, the feed roll being rotatable adjacent to and rotatable in the same direction as that of said shredding cylinder at a point remote from said feed roll, at least one intermediate breaker bar to engage partially shredded fabric from said shredding cylinder while said last fabric is further shredded by the garnet points of said first garnet roll, and a second garnet roll adjacent said first garnet roll, said garnet rolls being rotatable in opposite directions at differential speeds to perform final shredding.

2. The apparatus as claimed in claim 1 wherein the intermediate breaker bar includes an upper and a lower breaker bar.

3. The apparatus as claimed in claim 1 wherein the breaker bars are movable with respect to their respective rolls to effect an adjustment of the degree of shredding.

4. The apparatus as claimed in claim 1 wherein the differential speed of the garnet rolls is variable to effect an adjustment of the degree of final shredding.

5. The apparatus as claimed in claim 1 including an air blast injector directed at the adjaceny of the garnet rolls to remove the shredded fabric from the rolls and an exhaust duct to convey the removed shredded fabric from the apparatus.

6. Apparatus for shredding fabric and the like which comprises: a rotatable feed roll having peripheral teeth
for engaging and feeding fabric to be shredded, a shredding cylinder rotatable at a higher surface speed than and in the same direction as that of said feed roll, a breaker bar adjustably spaced from said shredding teeth between said roll and said cylinder to engage the fabric fed by said roll while the fabric is acted upon by the shredding teeth, a first garnett roll having peripheral garnett points and located adjacent to and rotatable in the same direction as that of said shredding cylinder at a point remote from said feed roll, a pair of adjustable intermediate breaker bars on either side of the point of adjacency to engage partially shredded fabric from said shredding cylinder while said last fabric is further shredded by the garnett points of said first garnett roll, and a second garnett roll adjustably mounted adjacent said first garnett roll, said garnett rolls being rotatable in opposite directions at variable differential speeds to perform final shredding.

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