Sept. 19, 1967

K. W. MARRINER

3,341,899

TREATMENT OF WOOL SLIVERS

Filed Aug. 11, 1964

3 Sheets-Sheet 1

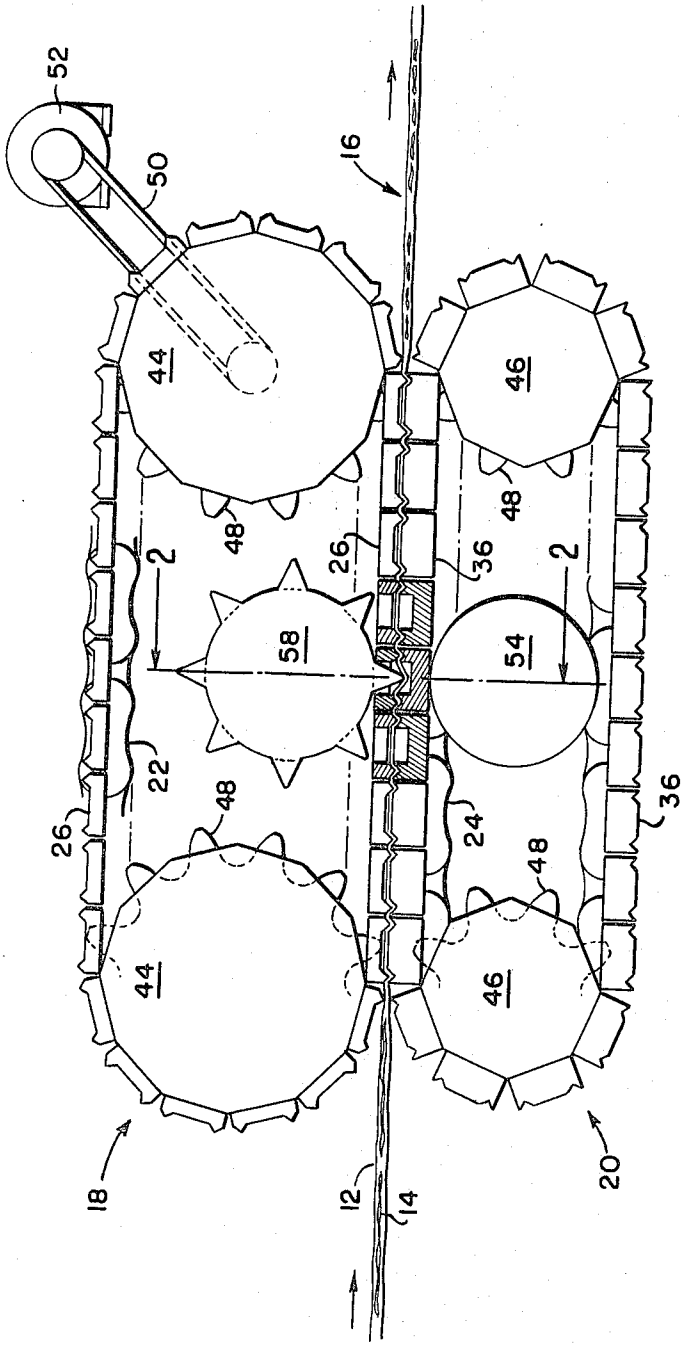


FIG. 1

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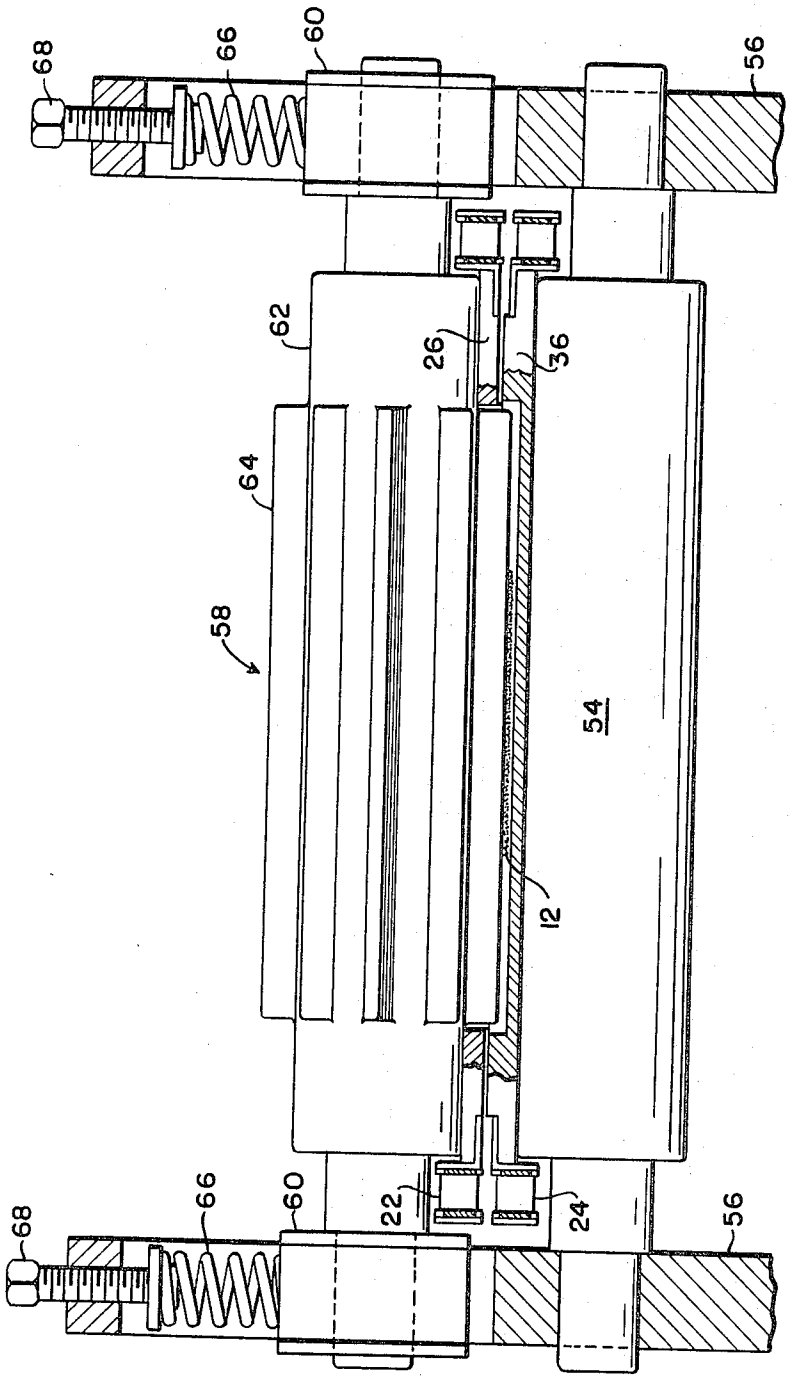


FIG. 2

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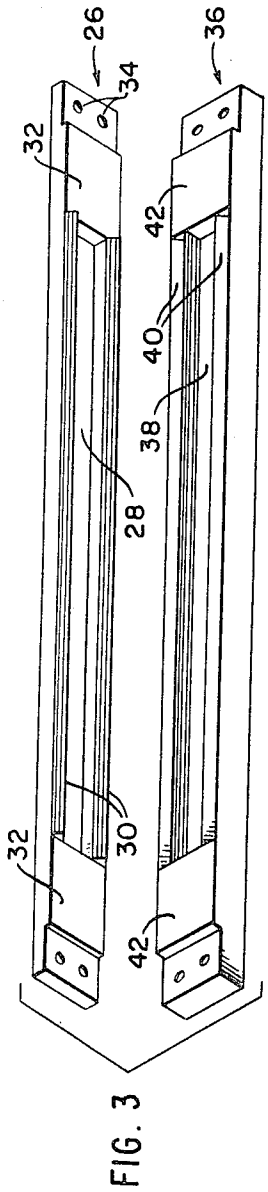


FIG. 3

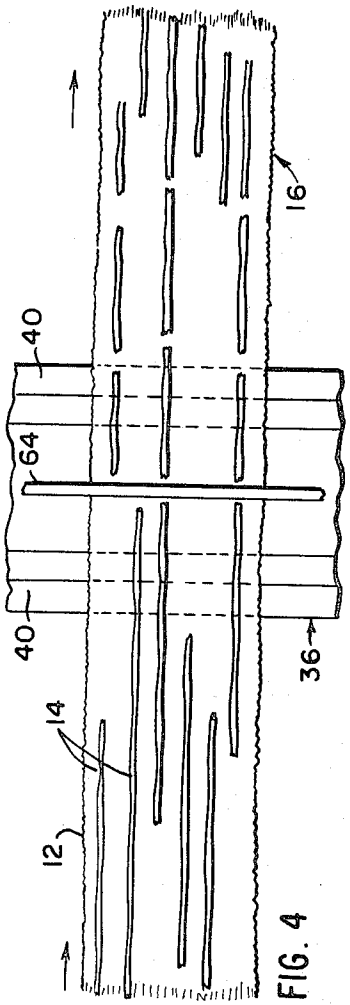


FIG. 4

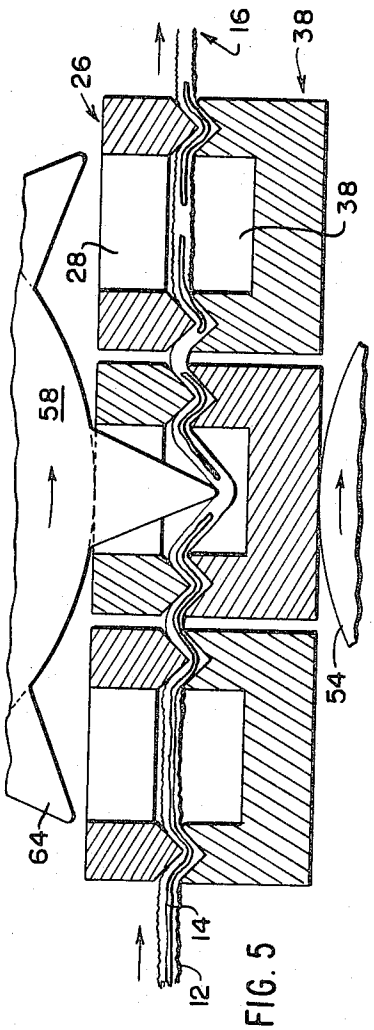


FIG. 5

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TREATMENT OF WOOL SLIVERS

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Filed Aug. 11, 1964, Ser. No. 388,878
7 Claims. (Cl. 19—66)

The present invention relates generally to the treatment of wool slivers and it more particularly concerns a method and apparatus useful in the removal of vegetable fibers normally found in the raw wool.

The prinicpal object of the invention is to facilitate the removal of all vegetable matter from the wool sliver before it is made into tops or processed into yarn. Of particular concern are the relatively tough, fibrous strands of straw, grass or weeds of lengths greater than about one-half inch and usually under three inches, which are often found in the oridanry commercial tops. These strands are often spun into the yarn and ultimately woven into fabric, from which they can be removed only by hand or by a carbonizing process.

This problem has long been recognized and solutions of various kinds have been attempted. It has been recognized, for example, that carding has a tendency to break up the vegetable fibers into smaller pieces, and the pieces under about one-half inch in length have a tendency to fall out of the wool during subsequent combing. Longer pieces do not have as great a tendency to fall out during combing. Vigorous carding is more effective in breaking up the vegetable fibers, but it also breaks up more of the wool fibers as well. In the interest of preserving a longer staple yarn, it is preferred to use a gentler carding operation and to employ some other means to remove the vegetable fibers.

The preferred conventional means include carbonizing the vegetable fibers at some stage up to and including the finished fabric, and crushing or crimping the wool sliver after it emerges from the cards. These methods are currently found throughout the industry. Carbonizing involves chemical treatment of the vegetable fibers to render them more easily removable. In crushing, the sliver is drawn between two polished steel rolls and reliance is placed upon the inherently greater resistance to crushing of wool fibers as compared with vegetable fibers. Crimping involves passing the sliver between specially designed teeth so as to bend the fibers at closely spaced intervals, with reliance being placed on the tendency of some vegetable fibers to break when sharply bent. These prior art methods are exemplified by the patent to Hoffman, No. 2,463,272 (crushing), and the patents to Hurst, Nos. 2,509,147 and 2,509,148 (crimping).

Besides the cost of the necessary machinery, each of the foregoing methods has its inherent operating disadvantages. Carbonizing may be harmful to the wool fibers. Crushing may also damage them and is further attended by the adhesion and build-up of vegetable matter on the steel rolls. Care must be taken to clean the rolls to insure a uniform crushing action on the sliver. Crimping is only partially effective because many vegetable fibers are not broken up by merely bending them.

The objects of the present invention accordingly include the accomplishment of effective breaking of vegetable fibers over ½" in length making them easier for subsequent removal without the foregoing disadvantages, and others well known in the art, which are attendant upon conventional methods.

With the foregoing and other objects hereinafter appearing in view, the features of this invention include the treatment of a wool sliver based upon the difference in the ability of wool fibers and vegetable fibers to stretch

longitudinally. In the sliver, these fibers are substantially aligned in parallel without twist. According to this invention, the sliver is gripped along a pair of transverse lines spaced lengthwise thereof, and all of the fibers between the gripping lines are then stretched by a distance approaching without exceeding the stretch capacity of the wool fibers therebetween, while being sufficient to cause the breaking of the vegetable fibers.

As used herein, the term "stretch capacity" applied to wool includes both the distance that the fibers will stretch by merely removing their natural crimp, and the further distance that the straightened fibers will stretch elastically without breaking. Wood fibers have a stretch capacity of 20% to 30%, while most vegetable fibers of concern have a negligible ability to stretch..

In carrying out the process according to this invention, the wool sliver is processed continuously by causing it to be gripped at successive intervals along transverse lines as it is conveyed from the gilling or pin-drafting machines before combing. The gripping lines are spaced at intervals close enough to insure the breaking up of the vegetable fibers into lengths that can be effectively released in the subsequent combing operation. For satisfactory operation, the resulting lengths are preferably one-half inch or under.

Another feature is the employment of a novel slat conveyor device adapted for high speed gripping of the moving sliver, operating in cooperation with breaker means for stretching the sliver. The slat conveyors provide means for gripping the sliver at closely spaced intervals and the breaker device has means mechanically projected against the sliver to stretch it by deflection transversely to its direction of travel, the stretching being sufficient to break the vegetable fibers between the gripping lines without substantially injuring the wool fibers.

Other features of the invention reside in details of the method and of the conveyor-breaker apparatus which will be more readily understood from the following description of the preferred forms thereof, having reference to the appended drawings, wherein

FIG. 1 is a side elevation, partly in section, of the preferred form of the apparatus;

FIG. 2 is an elevation partly in section taken on line 2—2 of FIG. 1;

FIG. 3 is a detail view showing slats of the conveyors;

FIG. 4 is a fragmentary plan view of a sliver passing beneath the breaker device; and

FIG. 5 is a detail fragmentary side elevation corresponding to FIG. 4.

Referring to the drawings, a wool sliver **12** is conveyed from cards or from a gill box or pin drafter of a conventional type at substantial operative speeds, for example six feet per second. Typically, the untwisted sliver has a width of six to eight inches and is relatively flat with the wool fibers substantially evenly distributed and in parallel, untwisted arrangement. Vegetable fibers **14**, such as grass or straw, of varying lengths are found in random distribution in the mass of wool fibers. According to this invention, the sliver is treated so that it emerges at **16** (FIG. 4) with the vegetable fibers still imbedded in the sliver, but now broken up into shorter lengths. In this condition, the sliver may then be fed to conventional combing equipment from which the vegetable fibers are readily released. The resulting wool top is then free of the foreign materials and makes an excellent high quality product for spinning into yarn.

To accomplish the breaking of the vegetable fibers, it is first necessary to grip the sliver along closely spaced transverse lines, and then to stretch the fibers between the gripping lines by an appropriate distance. To accomplish the purposes of this invention, it is necessary that this

distance be within the stretch capacity of the wool fibers, but greater than that of the vegetable fibers, so that the latter are longitudinally stretched to the breaking point. This distance, therefore, must be carefully controlled so as to preserve a long staple wool product, while still effectively breaking up all of the vegetable fibers.

The gripping of the sliver is accomplished by means of a pair of conveyors **18** and **20** (FIG. 1) each consisting of specially designed slats pivotally linked by means of endless link chains **22** and **24**, respectively.

The slats **26** of the conveyor **18** each have a rectangular opening **28** (FIG. 3) which is preferably slightly wider than the width of the sliver and passes entirely through the slat. A pair of gripping ribs **30**, preferably of at least the same width as the opening **28**, project from the plane of flat surfaces **32** on each side of the opening. Holes **34** are provided at each end to receive screws by which the slats are secured to the chain **22**.

The conveyor **20** has slats **36** (FIGS. 3 and 4) of a shape to match that of the slats **26**. The slats **36** each have an opening **38** in the form of a rectangular groove of the same length and width as the opening **28** in the slats **26**, but not passing entirely through the slat. Grooves **40** matching the ribs **30** of the slats **26** are provided, so that flat surfaces **42** may lie substantially flat against the surfaces **32** when the slats **26** and **36** are placed together with the ribs **30** in the grooves **40**. This is to permit gripping pressure to be applied to the slats through the surfaces **32** and **42** as further described below.

It will be apparent that various shapes of matching ribs and grooves may be provided, but the preferred form is a V-shape as illustrated. The effectiveness of the gripping action is partly a function of the applied pressure, and partly a function of the dimensions and shape of the gripping ribs. It will be understood that these ribs bend the vegetable fibers over an angle sufficient to prevent slippage when they are subsequently stressed and broken by the breaker device. This bending of the fibers, although mainly intended to prevent slippage, also breaks some of the fibers in a manner similar to the prior art crimping devices, thus contributing to the objects of the invention.

Moreover, this dual function of the gripping slats is effectively carried out when the gripping pressure is sufficient to grip the vegetable fibers, whether or not there is slippage of some of the wool fibers which are frequently of considerably smaller diameters. The optimum conditions for gripping the sliver are preferably determined by observing the effectiveness of the combing operation in removing substantially all of the vegetable fibers, and means are preferably provided for adjustment of the gripping pressure as described more fully below.

The conveyors **18** and **20** pass over corresponding pairs of drums **44** and **46**, respectively, the drums being fitted with sprocket teeth **48** engaging the chains **22** and **24**. The drums **44** and **46** are preferably mounted on fixed axes spaced so as to bring the slats **26** and **36** of the conveyors into closely fitted relationship with the sliver **12** firmly held between them. The conveyors are driven at the same peripheral speed so that the slats remain in firm fitting engagement throughout their common path of travel, as illustrated. Suitable drive means for the conveyors are schematically represented in the drawings by a belt **50** driven by a motor **52**. If desired, the conveyors may be separately driven by synchronized drive means, through a gear train for example.

Below the slats **36** as viewed in FIG. 1, there is provided a smooth surfaced steel cylindrical back-up roll **54**, preferably mounted in fixed bearings in the frame **56** of the machine. The roll **54** is preferably of sufficient width to oppose the flat surfaces **32** and **42** of the slats **26** and **36** as shown in FIG. 2.

A breaker device **58** in the form of a fluted breaker roll is mounted in slidable bearing blocks **60** in opposed

relationship to the back-up roll **54**. The bearing blocks are mounted for vertical sliding in the frame. The breaker roll has cylindrical end surfaces **62** (FIG. 2) and a number of intervening tapered flutes **64** shown in detail in FIG. 5. These flutes are preferably nearly as long as the openings **28** and **38** in the slats **26** and **36**, and are of sufficient depth to penetrate the openings **28** and to extend the desired distance into the openings **38**, thus stretching the sliver into the latter openings as shown.

The sliver is gripped by the conveyors throughout the distance over which the slats **26** and **36** are in fitted relationship. Positive gripping pressure is applied through adjustable compression springs **66** bearing at one end upon the bearing blocks **60** and at the other end upon adjustment screws **68** threaded in the frame **56**. As shown particularly in FIGS. 2 and 3, the breaker roll **58** is pressed downwardly by the springs and applies pressure through the flat surfaces **32** and **42** of the slats **26** and **36**, respectively, to the back-up roll **54**. Thus the thickness of the slats in the region of the flat surfaces **32** and **42** and the depth of the flutes **64** cooperatively determine the amount or percent of stretch applied to the sliver between the gripping lines. Generally, about a 20% stretch is sufficient.

The spacing of the gripping ribs lengthwise of the sliver and the spacing of the lines of impingement of the flutes on the sliver determine the maximum lengths into which the vegetable fibers are broken. Preferably, these lengths are no greater than one-half inch, so that conventional combing will effectively release all of the broken pieces.

Humidity and moisture content have an effect upon the kink or crimp in the wool in the sliver and upon its stretch capacity. To this extent, any adjustment in the percent of stretch applied by the machine should take these factors into account. In general, however, the invention can be effectively employed under ordinary mill room conditions and without special treatment of any kind.

The breaker roll 58 represents one form of breaker device which is preferred for its simplicity of construction and maintenance. Other forms of breaker devices may also be used, such as a periodically reciprocable plunger device or a plurality of such devices adapted to penetrate the openings **28** and **38** in the slats. Also, a plurality of breaker rolls may be employed, both above and below the slats, and these may or may not be directly opposed to the back-up roll or rolls. Tightener rolls may also be employed to take up slack on the conveyors.

Moreover, while the described machine contemplates gripping lines defined by ribs 30 and grooves 40 of fixed spacing, with the sliver being temporarily deflected transversely to its direction of travel, other means of stretching of the sliver may be used, such as gripping devices that separate progressively in the direction of travel of the sliver and in an accurately controlled manner between the entry and delivery ends of the machine.

Other variations in design, structure, configuration of the parts and modes of operation will also occur to those skilled in the art after a consideration of this invention, and are assumed to fall within the spirit and scope thereof.

Having thus described the invention, I claim:

1. Apparatus for treating a vegetable fiber-containing wool sliver including a pair of endless conveyors having linked slats, means to support each conveyor with a plurality of slats thereof each in opposed relation to and under pressure against a corresponding slat of the other conveyor, means to drive the conveyors at the same peripheral speed, the slats having transverse openings therein, means to feed the sliver between the opposed slats, and breaker means adapted to penetrate the opening in a slat and at least part of the opening in a slat opposed thereto to extend the portion of the sliver traversing said openings, wherein the vegetable fibers contained in the wool sliver traversing said openings are broken into shorter lengths.

2. The combination according to claim **1**, with back-up means cooperating with the breaker means to apply

gripping pressure to the sliver through the slats along opposed edges of the penetrated openings therein.

3. The combination according to claim 1, with means to cause the opposed slats to grip the sliver along opposed edges of the openings in the slats before and during penetration of the openings by the breaker means.

4. The combination according to claim 1, in which the breaker means is a roll having flutes extending transversely of the sliver.

5. The combination according to claim 1 in which the breaker means is a roll having flutes extending transversely of the sliver, and including back-up means cooperating with the breaker means to apply gripping pressure to the sliver through the slats, and means for resiliently forcing the breaker and back-up means toward each other.

6. The combination according to claim 1, in which the surfaces of the slats have matching ribs and grooves to grip the sliver.

7. The combination according to claim 1, in which the

slats are dimensioned and spaced so that the vegetable fibers will be broken by the breaker means into lengths sufficiently short to be released from the sliver by combing.

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