

[54] STAPLE FIBER CUTTER

3,557,648 1/1971 Coffin et al. 83/913 X

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[57]

ABSTRACT

[52] U.S. Cl. 83/346, 83/859

[51] Int. Cl. B23d 1/40

[58] Field of Search 83/37, 913, 187, 195, 567, 83/573, 346, 347, 859; 19/3, .32, 54

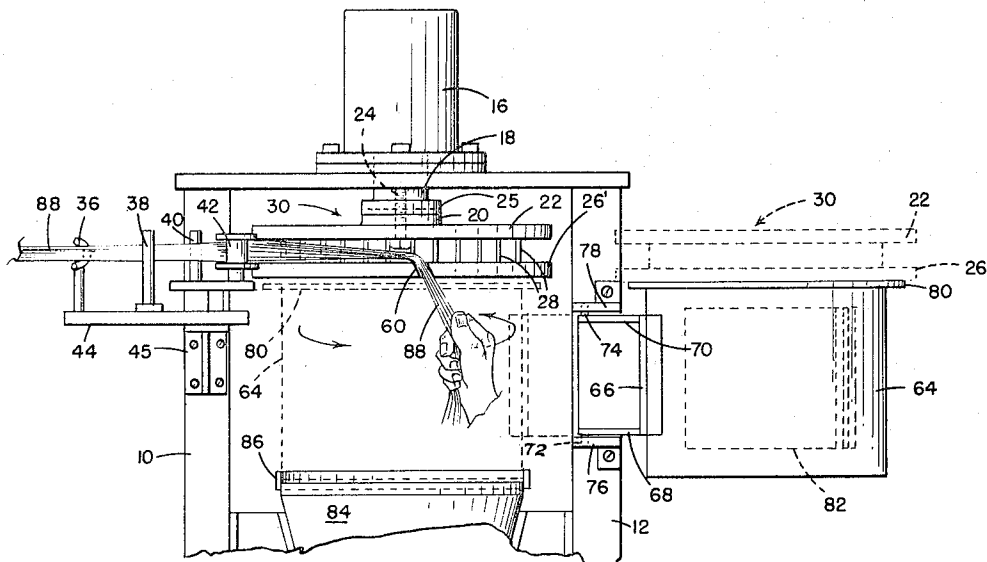
A commercially known fiber cutter which can be laced up for operation only when stationary or shut down is modified so that it may be laced while in operation and becomes useful with a tow which is being continuously produced as by a rayon or other continuous fiber spinning machine.

[56] References Cited

UNITED STATES PATENTS

3,485,120 12/1969 Keith 83/37

3 Claims, 4 Drawing Figures



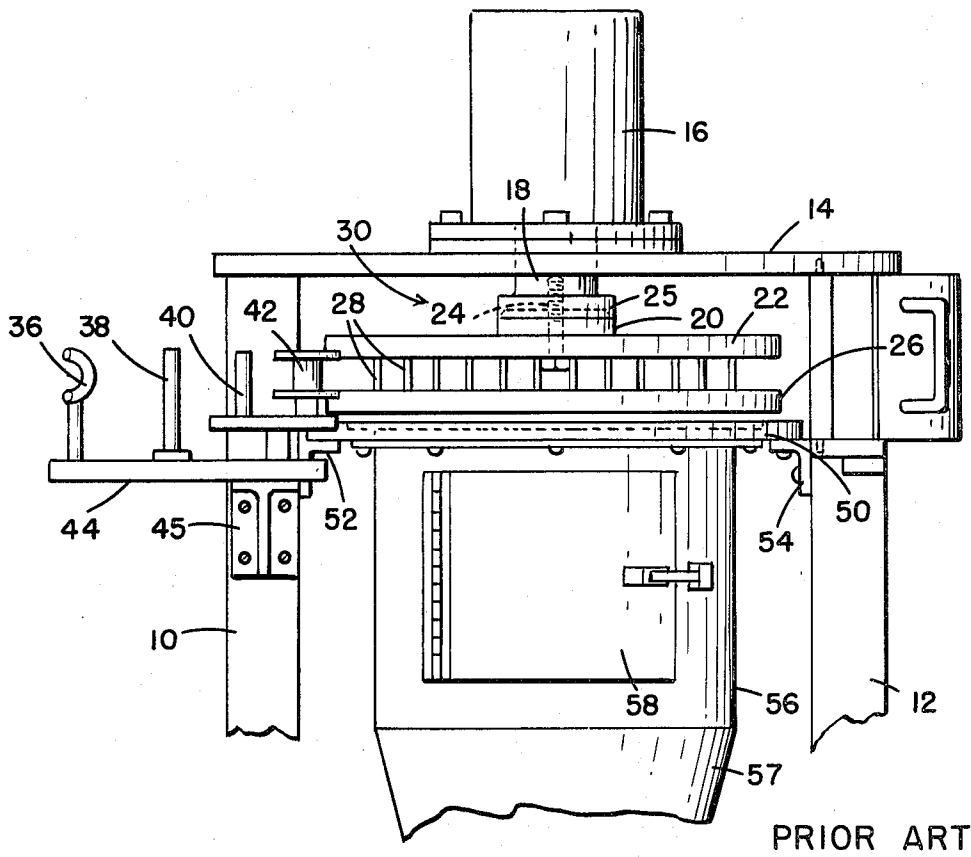


Fig. 1

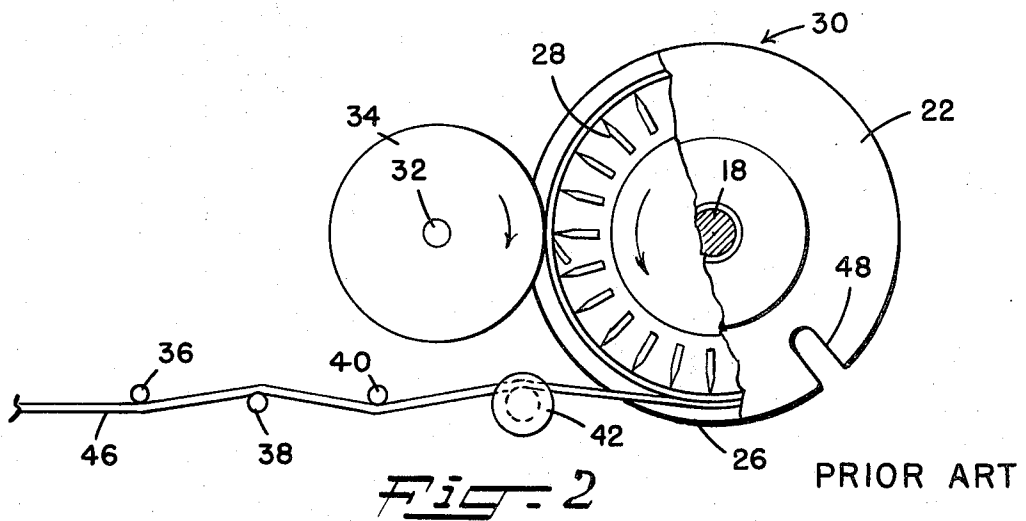
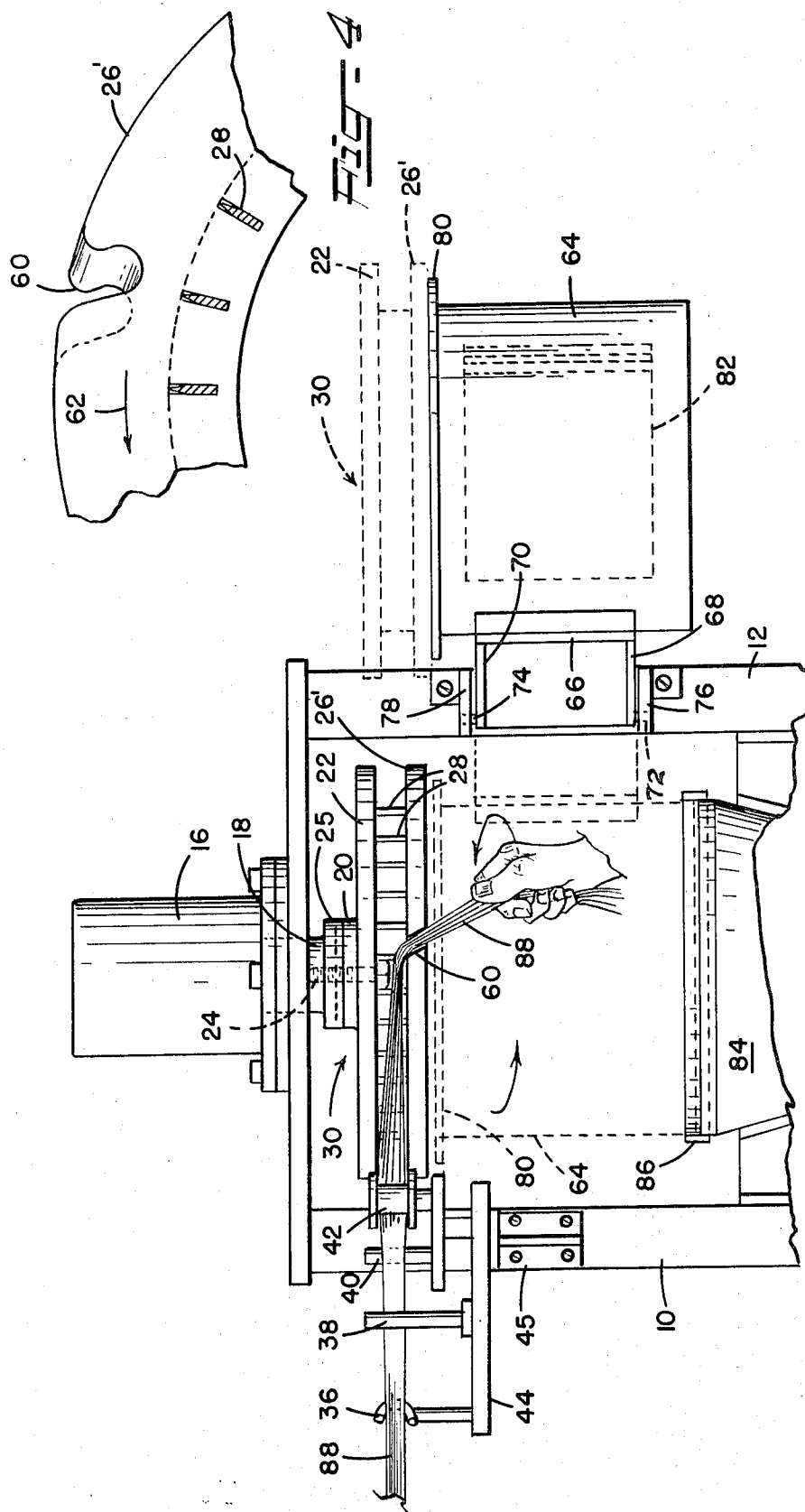


Fig. 2



STAPLE FIBER CUTTER

This invention relates to apparatus for cutting a tow of continuous filamentary material into staple fibers and more particularly to a cutter adapted for use with a tow which is being continuously produced by one or more fiber spinning machines, as well as with a tow which is pulled or formed from a previously spun stationary supply. More specifically, the present invention involves improvements over the fiber cutter described generally in the United States patent to Keith, U.S. Pat. No. 3,485,120, one manner of using which is described in the patent to Glynn et al, U.S. Pat. No. 3,503,100.

An apparatus incorporating the subject matter of the U.S. Pat. No. 3,485,120 is sold commercially by Lumtner Industries, Inc. under the designation, "Fiber Cutter Mark IV." Such an apparatus involves a reel having a winding surface formed of a multiplicity of blades extending between spaced flange forming members. The tow to be cut is wound on the reel as it rotates and after a predetermined number of wraps are built up the outermost wrap engages a roller mounted adjacent the reel and extending between the flanges of the reel. Pressure of the roller against the tow forces the innermost wrap against the edges of the blades to sever the tow into fibers of a length substantially equal to the spacing of the blades. The reel is detachably secured to the lower end of a vertically extending drive shaft and the cut fibers are forced between the blades into a hollow central region of the reel from which they drop into a hopper or funnel secured therebelow.

With the commercial apparatus, as well as with the apparatus shown in U.S. Pat. Nos. 3,485,120 and 3,503,100, there is no apparent way of initially anchoring the tow to the reel while the reel is rotating. Thus, it is not practicable to use this prior art apparatus for cutting a tow as the tow comes from a spinning machine because with the material being continuously produced it is necessary that it be taken up immediately by the reel as soon as it is engaged therewith to prevent the newly created tow from over accumulating between the spinning machine and the cutter. Furthermore, the blades of the reel become dull and it is necessary to change blades or more appropriately to change reels fairly often and if the apparatus is used with a continuous spinning machine it is, of course, desirable that this change be made as quickly as possible to minimize waste. The present invention provides a staple fiber cutter basically similar to that shown in U.S. Pat. No. 3,485,120 but which has provision for facilitating reel changes and for enabling a tow to be initially anchored to the reel while the reel is rotating.

It is an object of this invention to provide a staple fiber cutter generally similar to that shown in U.S. Pat. No. 3,485,120 but having improved means facilitating reel changes.

A further object of the invention is to provide a staple fiber cutter generally similar to that shown in U.S. Pat. No. 3,485,120 but having provision enabling a tow to be operatively connected thereto while the cutter is in operation.

Other objects, features and advantages of the invention will become apparent as the description of a preferred embodiment thereof proceeds.

Referring now to the drawing:

FIG. 1 is a side elevational view of a fiber cutter constructed in accordance with the prior art;

FIG. 2 is a diagrammatic plan view indicating the relationship between the cutter reel and a pressure applying roller;

FIG. 3 is a side elevational view showing the cutter modified to incorporate the present invention and indicating the manner of initially anchoring a filamentary tow; and

FIG. 4 is a fragmentary view showing a tow catching notch in the cutter reel.

Referring first to the prior art structure shown in FIGS. 1 and 2, the apparatus comprises a stationary framework including uprights 10 and 12 secured to the top of which is a heavy plate 14 supporting a suitable drive mechanism diagrammatically indicated at 16. The drive mechanism has a drive shaft 18 extending through an opening provided therefor in plate 14 and the hub 20 of a disk 22 is detachably secured by a bolt 24 to a flange 25 provided on the lower end of said drive shaft. Suitably secured in parallel spaced relation to disk 22 is a ring member 26 and extending radially outward between the disk and the ring member are a multiplicity of cutting elements or blades 28. Disk 22, ring member 26 and blades 28 together constitute a reel generally designated 30. The cutting edges of blades 28 lie in a circle having its center on the axis of rotation of the reel and form the winding surface of the reel. Disk 22 and ring member 26 are large enough in diameter to extend beyond the blades and thus form flanges for the reel.

Rotatable on a shaft 32 extending parallel to drive shaft 18 is a wheel or roller 34 which extends between the flanges of reel 30. Roller 34 is of a thickness only slightly less than the distance between the flanges of the reel. Shaft 32 is adjustable toward and from drive shaft 18 in any suitable manner to cause the periphery of the roller to come within a desired fixed distance of the path of movement of the blades 28 of the reel. A plurality of guides 36, 38, 40 and 42 are supported on a plate 44 fixed to an angle 45 secured to upright 10 for flattening a filamentary tow 46 as it approaches reel 30. Guide 42 is provided with flanges spaced the same as the flanges of the reel whereby to limit the width of the tow to no more than the spacing of the reel flanges. While the aforesaid U.S. Pat. Nos. 3,485,120 and 3,503,100 do not describe the manner of causing the tow to start to wind onto reel 30, according to actual practice a knot is tied in the end of the tow and the tow is inserted into a notch or slot 48 provided in disk 22 with the knot located above the disk and the following portion of the tow lying against the winding surface of the reel. The knot is of a size that it cannot slip through notch 48 and therefore serves to anchor the tow to the reel so that as the reel rotates, the tow will become wrapped in a plurality of layers about the winding surface formed by blades 28. This manner of initially anchoring the tow to the reel means that the apparatus is useful only with a tow which is taken from a stationary supply or at best from a supply which is being fed very slowly, for otherwise the time required to tie the knot and slip the tow into slot 48 would cause an undesirable build up of tow between the cutter reel and the place from which the tow was being fed. After a sufficient number of wraps have built up to fill the space between the path of blades 28 and the periphery of roller 34 further rotation of the reel causes the inner layer or wrap to be forced against the blades with sufficient force to sever the inner wrap each time a blade of the reel be-

comes radially aligned with the roller, thus cutting the continuous filament tow into staple fibers of a length substantially equal to the spacing of the cutting edges of blades 28. In practice, the reel is caused to rotate slowly after the tow is anchored thereto until sufficient wraps have been built up to cause the cutting to begin, whereupon the reel is stopped and the knotted end of the tow is manually withdrawn and discarded. Rotation of the reel at the desired cutting speed is then begun.

According to the prior art as illustrated in FIG. 1, a ring like member 50 is horizontally mounted beneath reel 30 on angles 52 and 54 adjustably secured respectively to uprights 10 and 12. Suitably secured to member 50 is a hopper 56 for catching the cut fibers as they drop down from a hollow central region of the reel into which the fibers are forced between the blades of the reel as they are cut. In this prior art apparatus, the lower portion of the hopper, indicated at 57, is funnel shaped and leads the fibers from the main body of the hopper to a suitable fiber conveying system or directly into a baling press. Hopper 56 is provided with a door 58 and when it becomes desirable to replace reel 30 with another one rotation of the reel is stopped and the operator opens door 58 and reaches with a suitable tool up through ring like member 50 to engage bolt 24. Loosening of bolt 24 permits reel 30 to move down onto the ring like member 50 from which it is shoved onto a table top dolly for further handling. In the actual apparatus itself, the reel weighs over 90 pounds and the blades are extremely sharp so that removing the reel and replacing it in the confined location between member 50 and the bottom of drive shaft 18 requires care and strength.

As previously indicated, the present invention involves modifications of the above described prior art structure and in FIG. 3 those parts which are the same as in the prior art are given the same reference characters as in FIG. 1. This invention includes a modification of the ring member forming the lower flange of reel 30 and in FIGS. 3 and 4 such member is indicated at 26'. Ring member 26' is provided with a notch or slot 60 in the outer periphery thereof which preferably slopes away from a radius of the ring with the bottom of the slot trailing the open end thereof in the direction of reel rotation, said direction being indicated by arrow 62 in FIG. 4. Ring member 26' is relatively thick and preferably slot 60 also slopes in the thickness direction of the member with the upper end of the slot trailing the lower end in the direction of reel rotation. The purpose of slot 60 will shortly be explained and while only one such slot has been shown it may in fact be desirable to provide more than one, a good number being four located 90° apart.

According to the present invention, a hopper 64 is connected to the upright 12 by a suitable hinge which may comprise a bail 66 secured to the hopper and having arms 68 and 70 respectively carrying pins 72 and 74 rotatably mounted in brackets 76 and 78 respectively secured to upright 12. Hopper 64 may be of any suitable shape and as shown is cylindrical and open at both the top and bottom. The hopper comprises a reel support member 80 in the form of a ring around the top thereof and is provided with a door 82 similar to the door 58 shown in FIG. 1. Located beneath the cutter reel at a distance slightly greater than the depth of hopper 64 is a funnel 84 having a semicircular flange 86 extending around and above the upper edge thereof. The

normal operating position of hopper 64 is shown in dotted lines and is determined by abutment of the lower edge of the hopper against the flange 86. In this normal position, the ring 80 of the hopper is located in alignment with and slightly below the lower flange 26' of the cutter reel. The hinged mounting of the hopper permits it to be swung from its normal position beneath the reel to a second position shown in full line where the region above the hopper is unobstructed.

With the new arrangement shown in FIG. 3, when it is desired to change reels the hopper is located in the dotted line position beneath the reel and the operator opens the door 82 and reaches up through the hopper with a suitable tool to loosen bolt 24 holding the reel to the flange 25 of drive shaft 18. Loosening of bolt 24 permits the reel to move down to where the lower flange member 26' thereof rests on the reel support member 80 of the hopper, it being here noted that the fixed ring like member 50 of the prior art shown in FIG. 1 is eliminated from the new form of apparatus shown in FIG. 3. With the reel resting on the support member 80 of the hopper, the hopper is swung to the full line position where easy access to the reel is permitted. One or more operators may then easily remove the reel from the top of the hopper and replace it with another, whereupon the hopper is swung back to the dotted line position to align the new reel with the flange 25. In practice, a bolt 24 is permanently associated with each reel and with hub 20 of the reel aligned with flange 25 of the drive shaft, tightening of the bolt raises the reel off of the support member 80 and snugly engages hub 20 against flange 25. There are interengaging means, not shown, on hub 20 and flange 25 which prevent relative rotation between the reel 30 and drive shaft 18. By employing the swingable hopper for transporting the reel to and from the confined region where it is connected to drive shaft 18, the time required for changing reels is substantially reduced and furthermore the operation is safer than with the prior art arrangement.

As previously mentioned, the cutter constructed in accordance with the present invention is particularly useful for cutting a tow which is at the time being continuously manufactured, for example, is being constantly ejected from a fiber spinning machine. With this type of operation, it is not practical to tie a knot in the tow and engage the knot with the stationary reel as is done with the prior art apparatus, which as previously mentioned, is only useful with a tow which is not being fed toward the cutter at the time of initially anchoring the tow to the cutter reel. With the present invention, when the cutter reel is to be changed as above described, the tow is cut at a point ahead of the apparatus just before the reel is stopped and the reel changing operation is begun. During changing of the reel, the tow which is still being continuously fed from the spinning machine may be allowed to accumulate as waste. When the new reel is attached and rotation thereof has been started, the hopper 64 is swung to the full line position to render the region beneath the reel unobstructed and readily accessible to an operator. The continuously fed tow, indicated in FIG. 3 at 88, is then cut between the spinning machine and the place where the waste has been accumulating to provide a fresh end which is then fed manually about guides 36, 38, 40 and 42 and into the vicinity of the rotating reel 30. The tow following the point where it is grasped by the operator is aligned with the winding surface of the reel between

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flange forming members 22 and 26' and the operator holds the end portion of the tow radially inward and beneath flange member 26' with a portion of the tow engaged with the periphery of said member. As notch 60 in the periphery of member 26' becomes aligned with the tow, it catches the tow and to prevent the tow from being pulled out of his hand, the operator thereupon manually rotates the end of the tow beneath the reel about the axis of the reel and at the same speed as the reel until the tow raps sufficiently about the winding surface of the reel to anchor the tow to the reel. Preferably, the operator rotates the end of the tow until sufficient wraps have built up on the reel to cause the innermost wrap to start to cut under pressure of roller 34 against the tow and the held end of the tow is then easily pulled free and discarded. The hopper 64 is then moved back to the dotted line position shown in FIG. 3.

Having thus described a preferred embodiment of the invention, what is claimed is:

1. In apparatus for cutting a tow of filamentary material into staple fibers comprising a reel having a winding surface formed of a multiplicity of cutting elements extending radially outward between flange forming members and wherein means is provided for forcing against the cutting elements the inner layer of a plurality of layers of tow wound on the reel and wherein the reel is detachably secured to the lower end of a vertical drive shaft and the lower flange forming member is a ring

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permitting fibers cut from the tow wound on the reel and forced inwardly between adjacent cutting elements to fall downward from a central region of the reel into a hopper located therebelow; the improvement comprising means mounting the hopper for movement between a first position directly beneath the reel to a second position where the region above the hopper is unobstructed, and a support member around the top of said hopper adapted to support the reel when the reel is detached from the drive shaft whereby the hopper may be used for transporting the reel between its normal operating position and an easy access position.

2. The apparatus set forth in claim 1 wherein the means mounting the hopper comprises a hinge securing said hopper to a stationary support.

3. The apparatus set forth in claim 1 including a tow catching notch in the outer periphery of the lower flange forming member of the reel for catching a tow held against said periphery as said reel is rotating, movement of said hopper to its said second position permitting an operator to have access to the region beneath the reel whereby the operator may hold the tow in the notch by manually rotating the end thereof about the axis of the reel until the tow wraps sufficiently about the reel to anchor the tow to the reel thus enabling the apparatus to be used for cutting a tow which is continuously being supplied by a spinning machine.

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