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STAPLE CUTTER VACUUM WASTE REMOVAL SYSTEM

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*Fig. 1.*

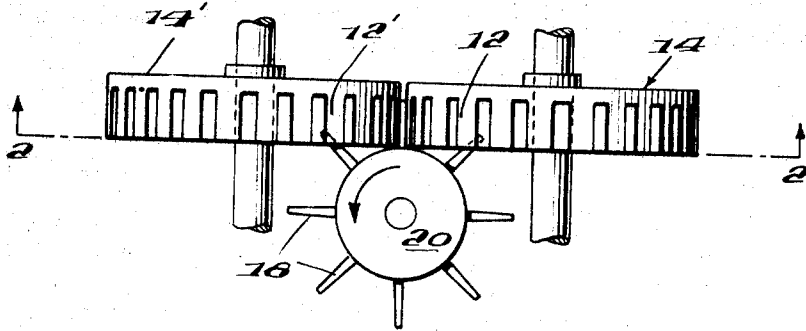


*Fig. 2.*

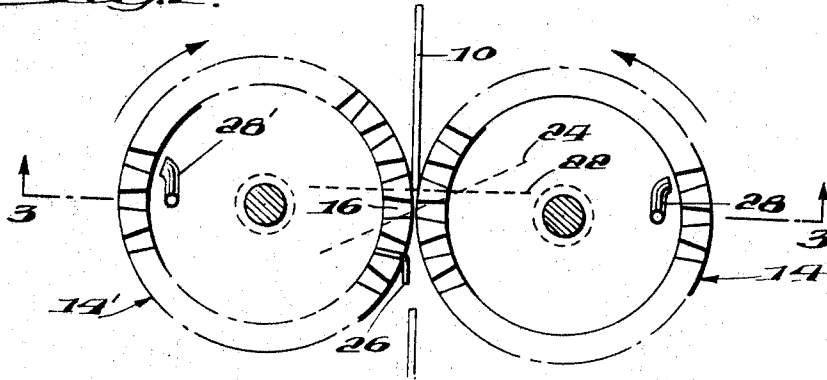
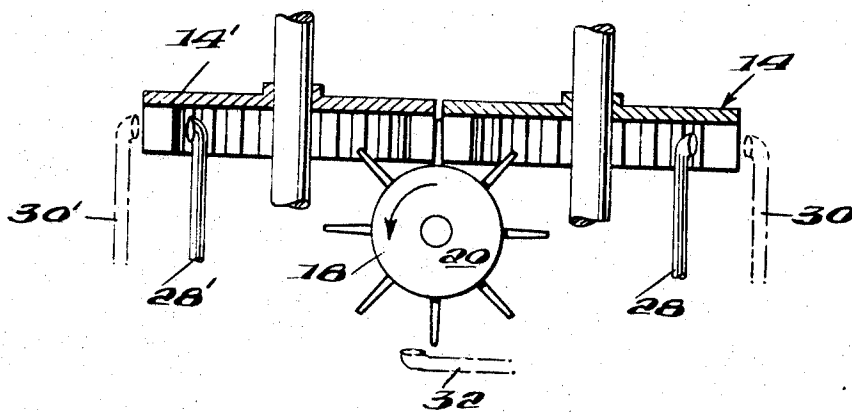


*Fig. 3.*



1

2

## STAPLE CUTTER VACUUM WASTE REMOVAL SYSTEM

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5 Claims

### ABSTRACT OF THE DISCLOSURE

A vacuum waste removal system for a staple cutter of the type embodying a pair of tow-clamping disks having a series of flange-teeth that register to grip the tow which is fed therebetween and cut by a rotating knife passing between abutting pairs of teeth. Vacuum nozzles are mounted in close proximity to the flange teeth and the cutter to pick up and separately dispose, from the cut staple product, non-standard staple lengths which cling to the disks and cutter blades.

This invention relates to staple cutters and more particularly to improvements therein for removing off-cut-length filaments.

U.S. Patent No. 2,851,103 describes a type of cutter which comprises two tow-clamping disks lying in the same plane in abutting relationship, on one face of each of which are affixed at their peripheries, a series of flange-teeth which register in such a manner as to grip a continuous-filament tow which is fed therebetween. The tow is cut by a rotating knife or cutting member synchronized to pass between pairs of abutting teeth.

In operation of this type of cutter, at most two or three pairs of teeth are in contact with the tow at any given time. The knife passes through the tow at a point slightly above the centerline of abutment. Thus, as the cut is made, the tow is firmly clamped in the area of the centerline of abutment while the next more-advanced set of teeth are releasing a cut chip and the next succeeding pair of teeth is just establishing clamping pressure. When broken filaments are present in the tow, they are oriented predominantly at the surface, since they occur most frequently by damaging contact with the crimper in the next previous step in process of manufacture. Since these filaments are not adequately tensioned by continuity to the next previous nip point, and are not yet firmly clamped by the pair of cutter teeth oriented above the line of knife passage, they will frequently not be cut. Instead, the knife will withdraw them from the as-yet uncut tow and push them into the between-teeth space. The resulting long end is then generally separated from the discharged chips as it hangs on the rotating disk. If allowed to recycle to the cutting zone, the long end may become entangled with the incoming tow and lead to off-cut-length contamination of the staple product. A means to prevent recycling of off-cut-length staple would be highly desirable.

An object of this invention is therefore to provide an improved cutter of the flying-knife type. A further object is to provide means for removal of off-cut-length staple to prevent product contamination thereby. Other objects and advantages will become apparent as the description of the invention proceeds.

The aforementioned objectives of this invention are accomplished by providing, in a cutter of the type including a pair of rotatable, contiguous tow-clamping disks having affixed at their peripheries a series of flanged teeth in abutting relationship adapted to grip and advance

tow therebetween and a rotatable cutting member or flying-knife cutter synchronized to pass through or cut said tow and pass between pairs of the abutting teeth, the improvement comprising at least one stationary, vacuum pick-up nozzle mounted in close proximity to the non-abutting or non-working side or edge of the teeth of at least one of said disks which serves to pick up the filaments which have been pushed into or caught in the space between and cling to the teeth by applying suction thereto. Where only one such nozzle is used, it is preferably mounted near or adjacent to the disk toward which the cutter or knife advances as it cuts the tow. One or more such nozzles may additionally be advantageously mounted in close proximity to the abutting or working side or edge of the clamping teeth, and if only one is employed it is again preferably mounted near the teeth of the disk toward which the tow is pushed by the knives during cutting.

Details of various embodiments for carrying out this invention are shown by way of example in the accompanying drawings in which:

FIGURE 1 is a plan view of a typical cutting apparatus with which this invention may be practiced;

FIGURE 2 is a sectional face view on line 2-2 of FIGURE 1 showing the positioning of vacuum nozzles near the non-abutting sides of the disks; and

FIGURE 3 is a sectional view on line 3-3 of FIGURE 2 further showing the positioning of optional additional vacuum nozzles near the abutting sides of the disks and near the cutting knives.

Referring in more detail to the drawings, tow 10 is gripped by teeth 12 and 12' of rotatable disks 14 and 14' and advanced to cutting position 16. Knives 18 of cutting unit 20 are rotatable in a plane which parallels and is slightly above the plane which includes the axes of rotation of disks 14 and 14', as indicated by dotted line 22. Alternatively, the plane of knife rotation may be canted with respect to the said planes as indicated by dotted line 24 if desired. By so doing, speed of rotation of the knives 18 may be reduced or the circumferential length of the knives may be increased for any given space between the radially spaced clamping teeth 12 and 12', without mechanical interference. Further variations and details may be seen by reference to U.S. Patent No. 2,851,103. A filament having a break is illustrated at 26 after being pushed into the open space between the teeth.

Stationary vacuum nozzles 28 and 28' are shown mounted near the non-abutting side or edge of teeth 12 and 12' to pick up off-cut-length staple. In FIGURE 2, nozzle 28' would pick up filament 26 from between the teeth of disk 14'. One or more such nozzles, 30 and 30', may advantageously also be mounted adjacent to the abutting or working side or edge of the clamping teeth of disks 14 and 14'. Preferably, whenever only one of nozzles 28 and 28' or only one of nozzles 30 and 30' are employed, it is located near the disk (14') toward which the cutter 20 advances as was hereinbefore described since more off-cut-length filaments will be forced into the teeth of disk 14' than those of disk 14. It has also been observed that filaments may be extracted from the tow and retained by the knives 18. Accordingly, it is also within the scope of this invention to additionally locate one of more of the vacuum nozzles, such as 32, in close proximity to knives 18 to pick up filaments therefrom.

Vacuum may be applied to these nozzles by any conventional means and the amount of vacuum employed will be whatever is necessary to apply sufficient suction to pick up the off-cut-length filaments being processed.

The nozzles will, of course, always be substantially directed toward whichever surface they are to apply suction to. That is, nozzles 28, 28', 30 and 30' will be sub-

stantially directed toward the teeth of the disks and nozzle 32 will be directed toward the knives 18.

In addition to providing a means for improving the quality of the staple cut, this invention has been found to be a useful indicator of quality of the continuous-filament tow. When the tow contains a large number of broken filaments, or damaged edges such as may arise in faulty crimping operation, a significantly larger number of fibers are collected by the vacuum nozzles. Such on-line evaluation of quality is valuable in early recognition of off-standard conditions and contributes materially to improved processes control.

It is also a characteristic of cutters of this type that impact of the knives on the tow creates extremely short fibers approaching a powder in consistency. This material, frequently termed "fly" or "snow" is also removed by the vacuum nozzles, thus further contributing to improved quality of the resultant product.

It will be obvious to one skilled in the art that the specific details of the embodiments disclosed may be altered materially without departing from the spirit and scope of this invention. Dimensions of and locations of the nozzles relative to the disks and cutter and the amount of vacuum may be varied widely depending on denier of the fibers, the cut length, speed of rotation of the disks or cutter, and so on to meet the essential criteria of waste pick-up efficiency and economical processing. Such adjustments are most conveniently made "in the field," since substantial flexibility in arrangement may easily be built into the apparatus of this invention. It is understood, therefore, that this invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. In cutting apparatus for tow comprising a pair of rotatable tow-clamping disks having affixed at their peripheries a series of flange teeth in abutting relationship which register in such a manner as to grip a continuous-filament tow being fed therebetween and a rotatable cutting member synchronized to pass through said tow and between pairs of said abutting teeth, the

improvement which comprises at least one stationary, vacuum pick-up nozzle mounted in close proximity to the non-abutting side of the teeth of at least one of said disks for applying suction to said teeth, said nozzles being directed toward said non-abutting side and away from the point of registry of the tow-clamping disks, and means for applying a vacuum to said nozzles.

2. Claim 1 wherein at least one of said nozzles is mounted in close proximity to the non-abutting side of the teeth of the disk toward which said cutting member moves as it passes through said tow.

3. Claim 1 further comprising at least one additional stationary, vacuum pickup nozzle mounted in close proximity to and directed toward the abutting side of the teeth of at least one of said disks for applying suction to said teeth, said additional nozzle being peripherally spaced from the point of registry of the tow-clamping disks, and means for applying vacuum to said nozzles.

4. Claim 3 wherein at least one of said additional stationary, vacuum, pick-up nozzles is mounted in close proximity to the abutting side of the teeth of the disk toward which said cutting member moves as it passes through said tow.

5. Claim 1 further comprising at least one stationary, vacuum pickup nozzle mounted in close proximity to said rotatable cutting member for applying suction thereto after said cutting member passes through said tow and means for applying vacuum to said nozzle.

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U.S. Cl. R.X.

83—102, 355, 913