Nov. 12, 1940. J. ELLIS 2,221,022

ROTARY STAPLE CUTTING MACHINE

Filed Oct. 18, 1939

FIG. 1.

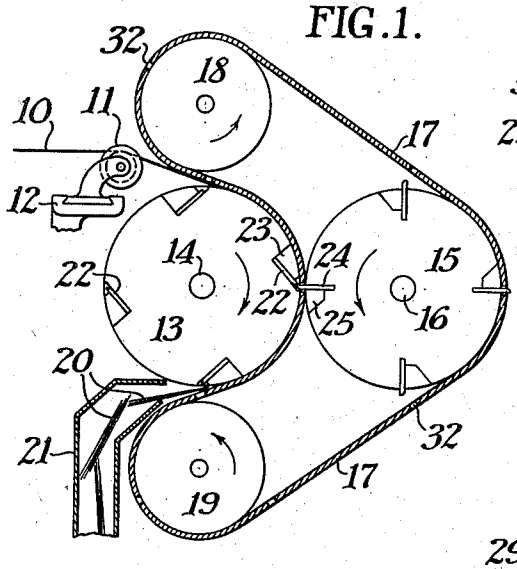


FIG. 2.

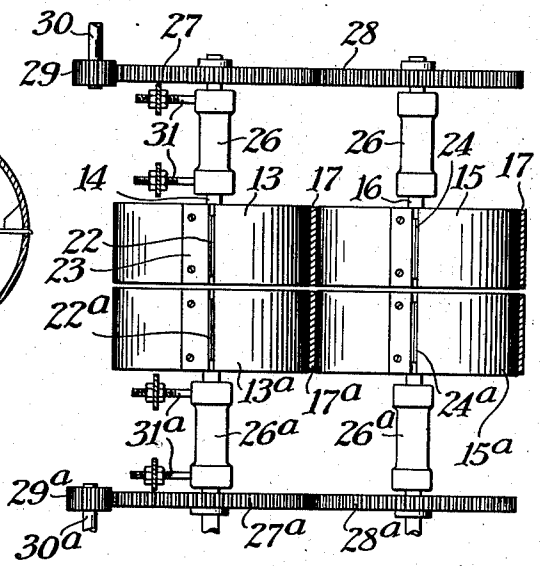


FIG. 4.

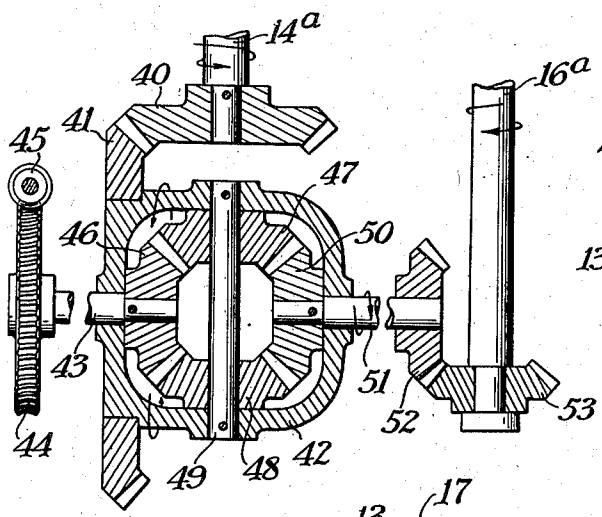


FIG. 3.

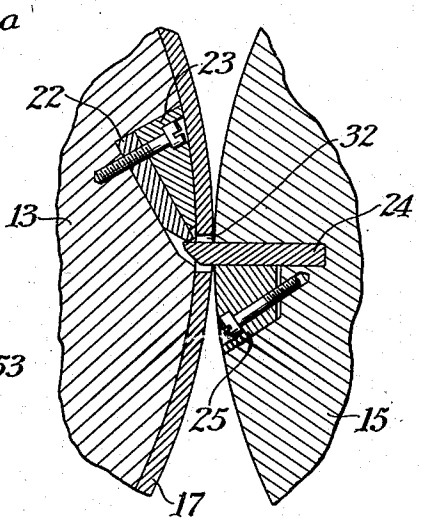
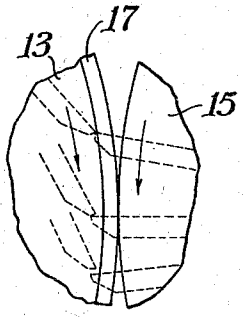


FIG. 5.



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ROTARY STAPLE CUTTING MACHINE

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2 Claims. (Cl. 164—68)

This invention relates to filament cutters for reducing continuous filaments of cellulosic material to staple lengths suitable for conversion into spun yarn on standard textile processing equipment.

One object of the invention is to provide a mechanism, the cutting elements or knives of which are readily replaceable. Another object is to provide adjusting means whereby wear of one of the knives relative to the other may be altered, with the mechanism running, to compensate for wear of the cutting surfaces. A specific object is to render the knives self-sharpening, thereby reducing maintenance costs to a minimum and assuring a proper cutting action at all times. Other objects will appear hereinafter.

These objects are accomplished by the following invention, which, in its broader aspects, comprises providing a rotary cutting mechanism wherein a pair of oppositely rotating rollers are arranged in juxtaposition so that two series of knives carried by the rollers may contact each other successively and sever filaments which are conveyed between the cutting edges of the knives by a belt system.

In the following description, I have set forth one of the preferred embodiments of my invention, but it is included merely for purposes of illustration and not as a limitation thereof.

In the accompanying drawing:

Fig. 1 is a diagrammatic side elevation of a mechanism embodying the invention,

Fig. 2 is a plan view of Fig. 1 in which certain minor details have been omitted,

Fig. 3 is a greatly enlarged fragmentary section of the parts shown in Fig. 1 and illustrating the action of the knives at one point in their movement,

Fig. 4 is a plan view in section of a suitable mechanism for relative adjustment of the knives and

Fig. 5 is a fragmentary diagram showing the knives as they meet and pass during the cutting operation.

As illustrated herewith, the roving or loosely twisted bundle of continuous filaments 10 to be reduced to staple lengths is fed over a guide roll 11, laterally movable in a slotted way 12. A roller 13, mounted on a driven shaft 14 is spaced from a similar roller 15 on a shaft 16 by approximately the thickness of an endless belt 17. This belt runs over two idlers or take-up pulleys 18 and 19, located above and below roller 13. Conventional means, not shown, may be provided for adjusting the pulleys 18 and 19 to maintain the desired belt tension.

The purpose of belt 17 is not to drive either of rollers 13 and 15, nor to equalize their speed, positive mechanical connections being employed for this purpose as will be described below. The primary function of the belt 17 is to act as a conveyor for the roving of filaments 10. It carries this roving around the periphery of roller 13 to the point of cutting and finally delivers the cut staples 20 into a chute 21 from which they are continuously drawn by suitable suction and conveyed to storage or to other processing equipment, as desired.

In passing over the roller 13 the roving is severed by knives 22 and 24. Knives 22 are of comparatively soft steel and are retained in place within the recesses by suitable clamping blocks 23. A somewhat similar series of knives 24, preferably of hardened steel, are equally spaced in recesses in the roller 15 and are retained by clamping blocks 25. The specific manner of mounting and adjusting knives 22 and 24 is illustrated in Fig. 3. It should be noted that knives 22 do not project beyond the periphery of roller 13, while knives 24 are of such length and are so adjusted as to project, not only beyond the periphery of roller 15, but also within the mouth of the recess in roller 13 as the two rolls rotate in opposite directions.

The shafts 14 and 16 are mounted in suitable bearings 26 and are provided, respectively, with meshing gears 27 and 28 as shown, the gear 27 being driven by a pinion 29 mounted on a primary driven shaft 30. Adjusting means for controlling the relative center-to-center space of rollers 13 and 15 may be provided, such as lock screws 31. The gears 27 and 28 insure the exact meeting of the working edges of knives 22 and 24 at every revolution of the rollers 13 and 15, once a correct adjustment of the knives has been attained.

To avoid the necessity of shutting down or stopping the mechanism when it becomes necessary to change or replace the knives, the whole assembly may be set up in duplicate, as indicated in Fig. 2, the second assembly being concentrically aligned with the first. In the drawing, the parts of this second assembly bear the distinguishing suffix "a" with like reference numerals. When so arranged, the guide roll 11 and the roving 10 may be moved laterally on the way 12 and the roving may then pass into the second series of rollers and belt when the latter are set in motion. This frees the first assem-

bly for adjustment or repairs without the necessity of stopping the roving as it comes from a spinning cabinet or supply package.

Referring to Fig. 3, as indicated above, the knives 24 project beyond or outside of the periphery of roller 15 through slots 32 in the belt 17. As the knives 22 and 24 approach each other, the sharp edge of 24 just slightly leads and passes the sharp edge of 22, as indicated by the upper group of broken lines in Fig. 5, and thus serves to cut the roving 18 which is passing between them. During rotation, the cutting edges of the softer knives 22 wipe across the upper faces of hardened knives 24, thus continually exerting a sharpening effect on the softer knives 22.

As the softer knives 22 will naturally wear faster than the hardened knives 24, it will be necessary from time to time to move or advance the roller 13 circumferentially very slightly to compensate for the wear of the softer knives. Means for accomplishing this result, without slowing or stopping the machines may be as shown in Fig. 4. In this arrangement, gears 27 and 28 (or 27^a and 28^a) are omitted, and the mechanism shown in Fig. 4 is substituted. This mechanism is somewhat similar to the differential gearing of an automobile. The primary shaft 14^a, corresponding to the shaft of roller 13 in the other figures of the drawing, is driven, by suitable connections, not shown, in the direction indicated by the arrow. This shaft carries a bevel pinion 40, which drives a bevel gear 41 that is integral with or fixed to a housing 42, the latter being free to revolve on a shaft 43. At the outer end of shaft 43 is a worm gear 44, engaging a worm 45 that may be turned manually. In effect, therefore, unless worm 45 is turned, the shaft 43 is locked in stationary position and the housing 42 may revolve around it. A miter gear 46 is pinned to shaft 43 and is therefore stationary also.

The housing 42 carries a pair of miter gears 47 and 48 revoluble on a stub shaft 49 fixed in the housing. Both of these gears engage another miter gear 50, pinned to a shaft 51 that has a miter gear 52 keyed to its outer end. The shaft 16^a of roller 15 also carries a miter gear 53 that meshes with gear 52.

If the shaft 14^a is revolved clockwise the gear 41 and housing 42 will also rotate as indicated by arrows in Fig. 4. The gears 47 and 48 then will roll around on the gear 46 which is held stationary by the worm gear 44 and worm 45. This action causes the gear 50 and shaft 51 to revolve as indicated, and thereby to revolve the shaft 16^a counter-clockwise at a speed corresponding to that of shaft 14^a, so that both rollers 13 and 15 are revolved in opposite directions as previously described.

If it is desired to advance one roller slightly to compensate for wear on the knives 22, it is necessary only to give the worm 45 a very small fraction of one turn, thereby minutely changing the position of gear 46 relative to the housing 42 and correspondingly turning shaft 16^a circumferentially a very slight distance from the position it formerly occupied with respect to shaft 14^a. Thus as knives 22 wear away due to their sharpening action against the hardened knives 24, this wear may be compensated for as above described.

An alternative method of increasing the shaving action of the hardened knives 24 on the soft knives 22 is to adjust the centers between the rolls 13 and 15 a little closer together by operation of the lock screws 31 of Fig. 2 as previously described. This will cause the blades 24 to project slightly further into the opposing recesses which hold the blades 22, thus bringing the blades into closer bearing relationship one to the other.

It will be obvious that the mechanism of my invention may be readily adapted for cutting staples of different lengths. This may be done, either by employing different sets of rollers 13 and 15, each of which set is provided with cooperating knives spaced apart circumferentially to give the desired staple length, or by employing a single set of rollers, each of which is of sufficiently large diameter to provide for a relatively large number of severing points. When the latter expedient is employed, the roller 13, for example, will be provided with a plurality of recesses and knives 22 which are so spaced apart as to give almost any desired staple length. In this case, there will be a corresponding number of recesses and knives 24 on roller 15, but the number of knives 24 actually employed will be determined by the staple length it is desired to cut.

For example, if it is desired to cut a staple of maximum length, only one knife will be employed, thus giving a staple having a length equal to the periphery of the roller 13. If, on the other hand, a staple of half this length is desired, two knives placed in recesses positioned at opposite sides of the periphery of roller 15 will be employed, and so on. It will of course be understood that the belt 17 may be provided with any number of slots to provide proper entrance for the knives into the desired corresponding recesses of the opposite roller 13.

While I have found it convenient to illustrate my invention by means of a simple roller and belt mechanism, it will be apparent that the belt may consist of or carry a sprocket chain and that each of the rollers 13, 15, 18, and 19 or any of them may be provided with sprocket teeth which coact with the belt.

It will be evident that my invention has many advantages. The mechanism is adapted for attachment to a single spinning cabinet in such manner as continuously to reduce the filament output of such cabinet to fibers of the desired staple length. It may be so positioned as to function as, or take the place of, the usual godet roll. On the other hand, the mechanism may be so mounted with respect to a plurality of cabinets as to provide for simultaneously cutting in staple fiber the output of all of the cabinets. In fact, this is the most economical manner in which to operate in actual practice.

One of the outstanding advantages of my invention is the fact that the device is, as explained above, self-sharpening. Another important advantage from the operating standpoint is the fact that the cutting blades may be adjusted while the machine is running to give a more effective cutting action. In addition, the belt feed to the cutting point keeps the filaments aligned in substantially parallel relationship and keeps them compacted so that the cutting action is easily concentrated at one point, thus giving a true even cut through the roving. The fact that the material is pinched between the rollers at the point of cutting also tends to hold the

roving firmly in place when the cutting operation occurs.

What I claim is:

1. A rotary staple cutter, the combination of contacting cutting rolls adapted to be driven in opposite directions at the same peripheral speed, pulleys rotatably mounted on opposite sides of but in close proximity to one of the cutting rolls, a slotted conveyor belt disposed over said pulleys and in contact with both cutting rolls at least at approximately the point of contact, one roll having recesses circumferentially spaced to register with corresponding recesses in the other roll and with the slots in the belt, cutting elements fixed in each recess, the cutting elements of one roll having such angular relation to the corresponding cutting elements of the other roll that upon registration with the slots in the belt, they project through said slots and into the recesses of the other roll and the cutting surfaces of the elements scrape or wipe across the cutting surfaces of the elements of the other roll.

2. In a rotary staple cutter, the combination of contacting cutting rolls adapted to be driven in opposite directions at the same peripheral speed, one roll having recesses circumferentially to register with corresponding recesses in the other roll, cutting elements fixed in each recess, the cutting elements of one roll having such angular relation to the corresponding cutting elements of the other roll that the cutting surfaces of the elements of one roll scrape or wipe across the cutting surfaces of the elements of the other roll when the rolls are rotated, and means for adjusting the angular relation of the cutting elements of one roll with respect to the other, said adjusting means comprising an epicyclic gear train connecting the shafts of the respective rolls.

JAMES ELLIS.