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J. R. STEWART
PREPARATION OF STAPLE FIBERS
IN CONDITION TO PRODUCE TOP

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3 Sheets-Sheet 2

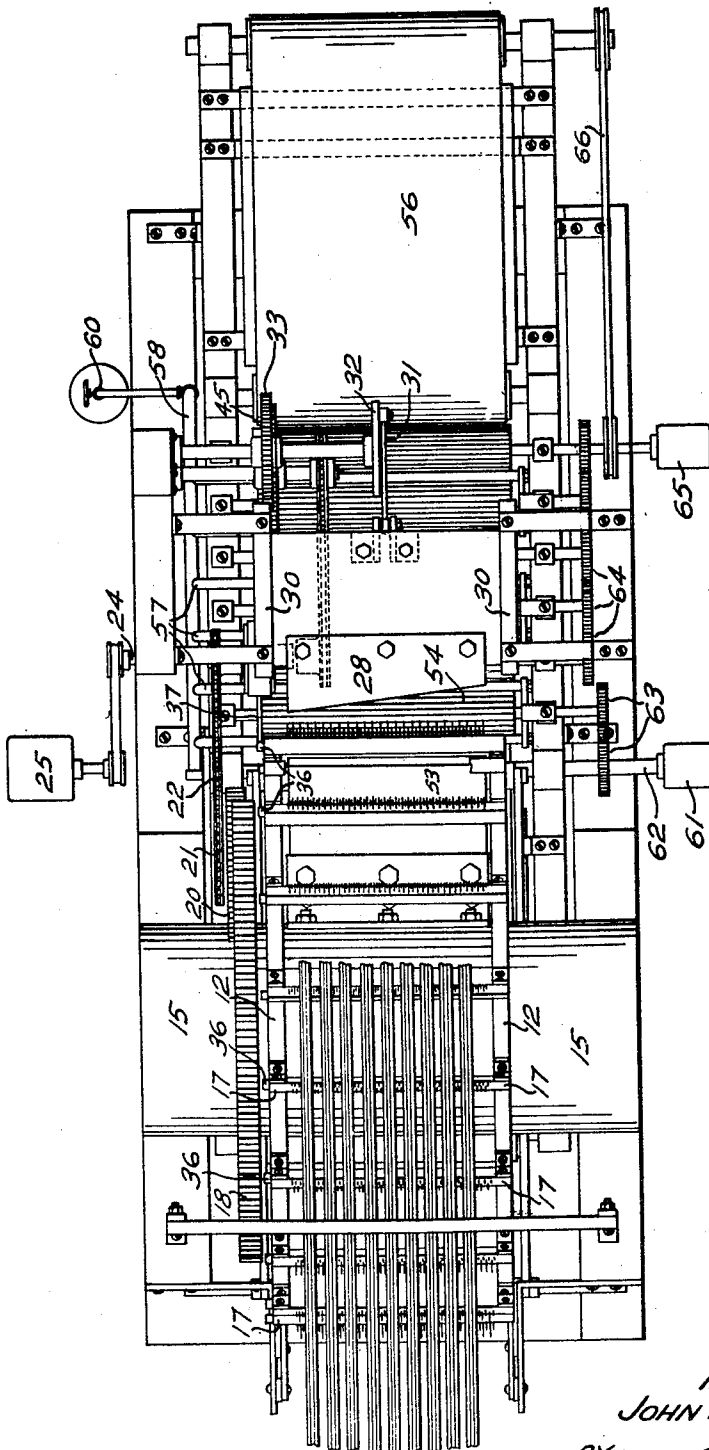


Fig. 2.

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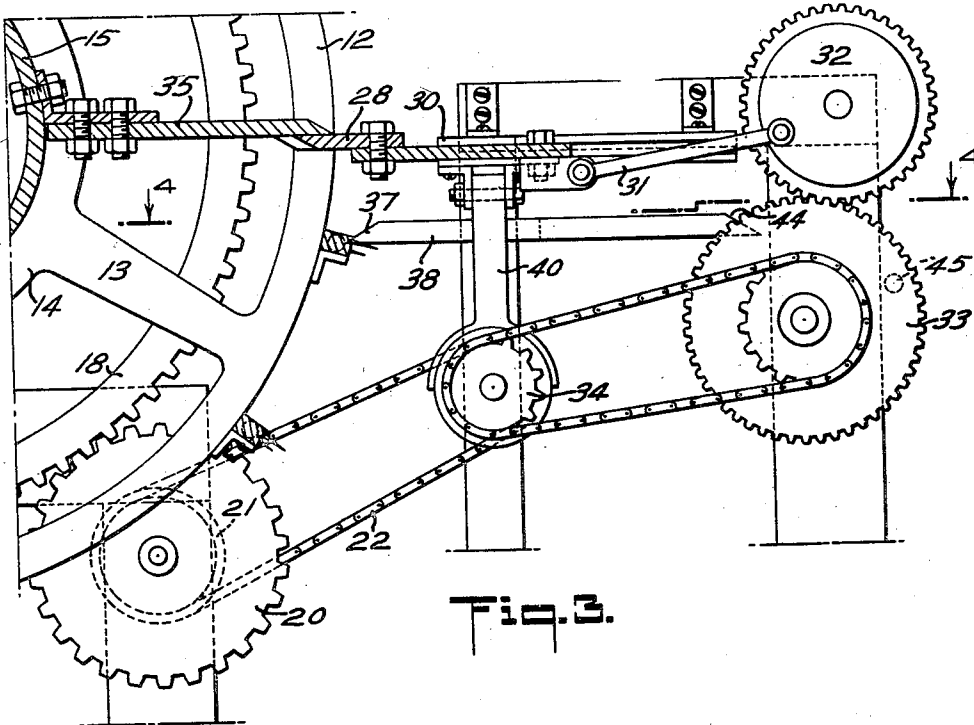


Fig. 3.

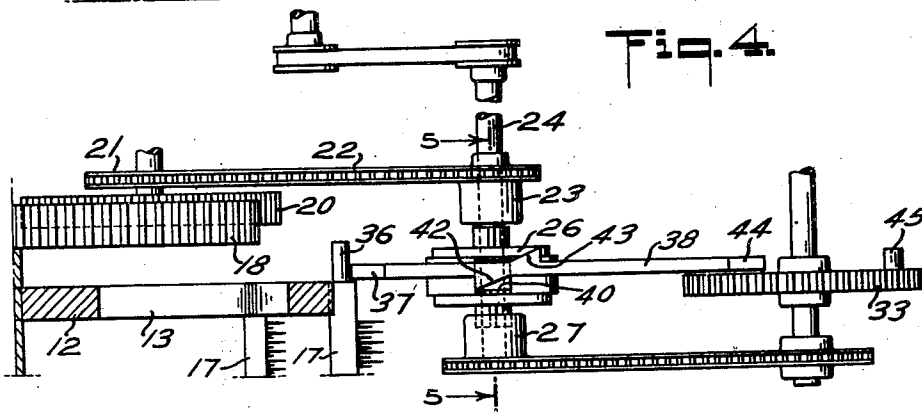


Fig. 4.

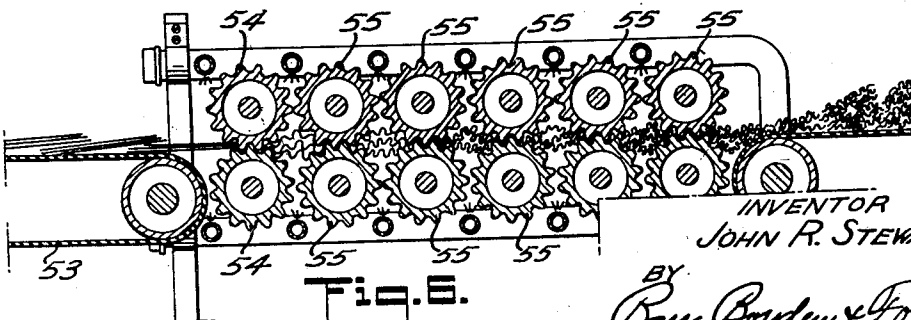


Fig. 6.

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PREPARATION OF STAPLE FIBERS IN
CONDITION TO PRODUCE TOP

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7 Claims. (Cl. 19—155)

1

The present invention relates to the processing of textile fibers, such as cellulose fiber, rayon fiber, artificial silk, and natural silk, and relates more particularly to a method and apparatus for cutting tow, namely strands of continuous fiber, and preparing such cut or staple fibers to form a web ready for transforming directly into top.

Heretofore in the processing of such fibers it has been customary to supply staple fibers in a conglomerate mass which has to be carded, combed, and passed through the steps common to the treatment of cotton and wool to remove short ends or nolls before the completed sliver is ready for spinning and finishing. This variation in staple lengths, resulting in a by-product of nolls, is due primarily to the breaking of the fibers in the carding process and subsequent preparing and these short ends have to be removed by combing.

Some of the objects of the present invention are: to provide an improved method and apparatus for converting tow into a form to produce top; to provide an apparatus whereby continuous lengths of fiber, such as artificial silk, rayon, and the like, can be cut and formed without carding or combing for delivery as a sliver directly to the finishing and spinning machines; to provide an apparatus for preparing cut staple fibers from continuous fibers whereby the resulting product is free from short ends or nolls; to provide an apparatus whereby staple fibers cut from continuous fibers are intermeshed in a lofted condition; to provide an apparatus for cutting staple fibers from continuous fibers wherein provision is made for cutting the fibers into predetermined and variable lengths; to provide an apparatus for operating upon staple fibers in such manner as to crimp the fibers during a feeding operation as distinguished from a drawing operation which attenuates the fibers; to provide means for feeding overlapping staple fibers so that the respective fiber ends are delivered to a gill box in spread and uneven relation to facilitate individual fibers being nipped by the gill box feed rollers; and to provide other improvements as will hereinafter appear.

In the accompanying drawings, Fig. 1 represents a side elevation of a staple fiber preparing machine embodying one form of the present invention; Fig. 2 represent a plan of the same; Fig. 3 represents a detail partly in section and on an enlarged scale of the intermittent feed and cutting knife mechanism; Fig. 4 represents a section on line 4—4 of Fig. 3; Fig. 5 represents a section on line 5—5 of Fig. 4; Fig. 6 represents

2

a sectional detail taken transversely of the crimping rollers; and Fig. 7 represents a plan of a bunch of staples as laterally crimped or displaced while traversing from one pair of rollers to the next.

Referring to the drawings, one form of apparatus embodying the present invention is shown consisting of a device for feeding strands of tow respectively from wound balls of tow 10 mounted for unreeling upon a suitably supported shaft 11. In this instance the feeding device consists of two rings 12 spaced apart the required distance to receive between them the row of tow strands being delivered and each ring 12 is supported by spokes 13 from a hub 14, which latter is arranged to revolve about a fixed tube 15 anchored to two spaced bases 16. The two rings 12 are circumferentially interconnected by pin-carrying bars 17 which are adjustably mounted upon the ring rims in order that the circumferential spacing between adjacent bars can be varied as a means for predictably obtaining the length of staple to be cut from the continuous filaments of which each tow strand is composed.

For causing the feeding device to revolve with a step-by-step motion, the outer face of one of the rings 12 carries a gear 18 in mesh with a gear 21 arranged to be driven by an attached sprocket 21 through the medium of a chain 22 and sprocket clutch member 23. The member 23 is freely rotatable upon a shaft 24 driven from the main drive motor 25 and having a movable clutch element 26 keyed thereon for sliding movement axially thereof for clutching engagement with the clutch member 23. At the opposite side of the movable element 26, from the member 23, there is a second clutch member 27 mounted for free rotation upon the shaft 24, the arrangement being such that when the movable element 26 is in clutching engagement with the member 23, the tow feeding assembly will rotate to advance the tow to a severing point.

In order to cut the tow into desired staple lengths, a knife blade 28 is provided having the required length to cut all of the strands of tow being delivered and is mounted in fixed ways 30 to move radially across the space between the rings 12 at predetermined intervals to cut definite lengths of staples. Reciprocating motion is transmitted to the knife blade 28 by a link 31 interconnected between the blade and a crank disc 32 in the form of a gear which is in mesh with a gear 33 driven by a chain and sprocket connection to the sprocket 34 upon clutch member 27. The cutting action of the blade 28 is

coordinated with a bed plate 35 attached to and projecting radially from the tube 15 in order to terminate in close proximity to the strands of tow being fed.

For the purpose of alternately operating the feeding device and the knife blade in proper timed relation, one end of each pin bar 17 is provided with a projecting lug 36 which serves to engage the cam end 37 of a shift bar 38 and move it laterally to transmit a rocking motion to the pivoted clutch shift lever 40. One end of this lever 40 is in forked engagement with the clutch 26 while the opposite end is provided with a slot 41 serving as a guide for the shift bar 38. Opposite sides of the bar 38 are provided respectively with projecting cams 42 and 43 which are arranged to rock the shift bar 38 to select one clutch member or the other according to the direction of movement. The length of the bar 38 is such that in one extreme position the cam end 37 is in the path of a pin bar lug 36 while the opposite end, which terminates in a cam end 44, is removed from the path of a pin 45 upon the crank disc 33. Thus, when a lug 36 rides along the cam end 37 it will shift the bar 38 so that the clutch shift lever 40 will be rocked by the cam 42 and thereby engage the clutch to operate the knife blade 28. This shift of the bar 38 brings its cam end 44 into the path of the pin 45 and as the latter completes its revolution it picks up the bar 38 and thereby rocks the shift lever 40 in the direction to re-engage the clutch which starts the feeding device turning until the next lug 36 engages and passes the end of the shift bar 38.

For doffing the cut staples, a doffing roller 46 is provided and extends below the point of severance of the cut staple and has its ends respectively connected to operating bars 47 which are pivoted to a cross rod 48 arranged to be shifted forward and back. Two adjustable tension springs 49 are connected respectively to the bars 47 in close proximity to the doffing roller 46 and are stretched from a fixed point upon the machine frame. The reciprocation of the doffing roller 46 is effected by means of a lever system 50 suitably pivoted to a bracket 51 and including a trip arm 52 in the path of and arranged to be actuated in proper timed relation by the pin bar lugs 36. Thus, as each row of staple fibers is cut from the delivered tow, the doffing roller 46 will be retracted to nip the depending ends of the staple fibers against a horizontally travelling apron 53. Thus, the cut lengths are positively and accurately placed upon the apron 53 maintaining the desired parallel relation of the fibers, and furthermore causing successive rows of cut fibers to have a predetermined overlap as determined by the spacing of the pin bars 17. The delivery end of the apron 53 terminates in such close proximity to a pair of driven corrugated feeding rollers 54 as to ensure the forward ends of the staple fibers being accurately fed between the aforesaid rolls 54. Preferably the rollers 54 are driven at the same peripheral speed as the linear speed of the apron 53 so that the successive rows of staple retain the initial overlapping and parallel relation.

For the purpose of causing the fibers of each cut strand, as well as the fibers of adjacent cut strands, to be intermeshed and relatively displaced, a plurality of pairs of parallel corrugated rollers 55 are mounted in alined relation to form a path for the cut strands leaving the rollers 54, it being understood that all roller pairs are suf-

ficiently close together as to guide the staples from one pair to the next pair. As shown, there are six pair of rollers 55 and each pair is arranged to be independently rotated by suitable driving means so that the speed of the roller pairs is progressively slower considered from the feed roller pair 54. Thus, while the roller pair 54 preferably rotates at the same speed as the apron 53, the next adjacent pair of rollers 55 runs at a slower speed than the roller pair 54, and each succeeding pair of rollers 55 rotates at a slower speed than its preceding pair. Thus, between any pair of the rollers the trailing ends of the staple fibers are travelling faster than the leading ends and as a result each fiber is subjected to a rearward crowding or lateral buckling action, so that as each bunch of staples leaves a pair of rollers its leading end has its fibers spread unevenly or staggered and consequently the next pair of rollers nips substantially individual fibers instead of a closely bunched group of fibers. This promotes laterally overlapping and intermeshing of the web which is being formed in successive steps. By reference to Fig. 6, it will be seen that the staple lengths enter the pair of rollers 54 in overlapped condition to receive a vertical crimping and then pass to the second pair of rollers 55 which, due to the slower speed of rotation, crowd the fibers laterally to produce generally the appearance illustrated in Fig. 7. Hence, the several bunches of staples receive a dual crimping, one caused by effective pressure of the fluted or corrugated rollers, and the other by the retarding action of the forward rollers. This composite crimping is carried out successively along the series of rollers, each operation resulting, as indicated in Fig. 6, of more and better intermingling of the fibers, until at the discharge end of this crimping mechanism a complete transverse web of intermixed fibers is delivered to a travelling apron 56 from which it enters an intersecting or open gill box, to be drawn and straightened into a sliver ready for the finishing operations to obtain a finished sliver or top of required weight and evenness.

While the result of the rearward crowding of the fibers plus the crimping action is a composite web of crossed lengthwise arranged fibers suitable for finishing without carding or combing, the present invention comprehends the lofting of the fibers, preferably, but not necessarily, at the same time the compressing or crowding and crimping of the fibers takes place. One form of apparatus for lofting the fibers consists in locating air supply pipes 57 above and below the space between adjacent pairs of rollers, such pipes having perforations for discharging air under pressure through the strands while the strands are feeding from one pair of rollers to the next. The pipes 57 are supplied with compressed air by way of header 58 from a suitable source 59 as will be understood. Thus, the spread interspersed and crimped fibers are caused to be lofted while passing through the rollers and thereby open up the intermeshed fibers.

In connection with the pin-carrying bars 17, it should be noted that each is adjustably mounted upon the rings 12 so that by changing the circumferential position of any bar relative to the next adjacent bar, the intermittent feeding of the strands can be varied as desired to produce predetermined staple lengths, either uniform lengths, (for example, all five inches, all four inches, or other lengths) or in variable lengths varying, (for example, from three to five

5

inches, three and one-half to six inches, etc.). Furthermore, the doffing system lends itself for proper overlap control whatever the cut lengths may be, since the speed of the doffing apron and roll can be adjusted to overlap, for example, from five and seven-eighths inches down to three inches, or otherwise according to the character of the tow and/or size of the filaments.

For driving the apron 53 and pair of rollers 54, an electric motor 61 is conveniently mounted to drive the shaft 62 of the apron 53 and also to transmit motion through gears 63 to the driven roller of the pair 54. The succeeding pairs of rollers 55 are arranged to be driven at successively slower rates by a chain of gears 64 and an electric motor 65, which latter also supplies power to the apron 56 by a belt drive 66.

Having thus described my invention, I claim:

1. An apparatus for forming a web of intermingled staple fibers from staple fibers of predetermined overlapped lengths comprising a pair of rotatable feed rollers, means to actuate said rollers, means to feed a series of overlapped staple fibers between said rollers, a second pair of feed rollers arranged to receive said staple fibers from said first pair of feed rollers, means to rotate said second pair of feed rollers at a slower speed than the speed of said first pair of rollers, whereby the leading ends of said fibers are retarded to crimp said fibers laterally, and means to direct a stream of air through the crimped fibers to form a web of intermingled relatively open fiber network.

2. An apparatus for preparing staple fibers from continuous length filaments comprising means for feeding continuous lengths of filaments to a severing point, a cutting knife, means for alternately operating said feeding means and said cutting knife to cut said lengths into successive rows of staple fibers, means for supporting said rows on said feeding means suspended from the cut ends, a travelling apron moving to intercept the free ends of the respective suspended cut lengths, a doffing member, means actuating said doffing member to clamp said free ends against said apron to start a progressive laying of said cut lengths on said apron to finally remove said lengths from said feeding means, whereby one row of cut staple fibers overlaps the preceding row by a predetermined distance while maintaining the leading ends of all cut lengths in each row in transverse alignment, pairs of rollers operatively associated with said apron for feeding said fibers to a discharge point, and means for progressively slowing the speed of rotation of each pair of rollers with respect to the preceding pair of rollers, whereby a web of intermingled, crossed fibers is delivered to said discharge point with the respective fibers of the leading ends of each row of cut lengths in axially staggered relation considered lengthwise of the fibers.

3. An apparatus for preparing staple fibers from continuous length filaments comprising means for feeding continuous lengths of filaments to a severing point, a cutting knife, means for alternately operating said feeding means and said cutting knife to cut said lengths into successive rows of staple fibers, means for supporting said rows on said feeding means suspended from the cut ends, means to vary the feeding means to change the lengths of the cut staple fibers, a travelling apron moving to intercept the

6

free end of the suspended cut lengths, a doffing member, means actuating said doffing member to clamp said free ends against said apron to start a progressive laying of said cut lengths on said apron to finally remove said lengths from said feeding means, whereby one row of cut staple fibers overlaps the preceding row by a predetermined distance while maintaining the leading ends of all cut lengths in each row in transverse alignment, pairs of rollers operatively associated with said apron for feeding fibers to a discharge point, and means for progressively slowing the speed of rotation of each pair of rollers with respect to their preceding pair of rollers, whereby a web of intermingled, crossed fibers is delivered to said discharge point with the respective fibers of the leading ends of each row of cut lengths in axially staggered relation considered lengthwise of the fibers.

4. The method of preparing a web of intermingled staple fibers from continuous length filaments, which consists in feeding continuous parallel filaments to a severing point, anchoring said filaments at predetermined locations while feeding, cutting said filaments successively at said locations to form a plurality of rows of suspended selected length staples, supporting and moving transversely the free ends of successive rows of suspended staples while feeding the anchored ends to cause each row of said staples to overlap the preceding row of staples in predetermined overlapped relation and with all staples of each row parallel, successively releasing the anchored ends of successive rows of said suspended staples, causing the overlapped rows of staples to travel together in partially superposed relation, and transversely staggering the leading ends of the staples of each row while travelling to form a web of intermingled fibers.

5. An apparatus for preparing staple fibers from continuous length filaments comprising means for feeding continuous lengths of filaments to a severing point, a cutting knife, means for synchronously operating said feeding means and said cutting knife to cut said lengths into successive rows of staple fibers, means for supporting said rows on said feeding means suspended from the cut ends, a travelling apron moving to intercept the free ends of the respective suspended cut lengths, a doffing member, means actuating said doffing member to clamp said free ends against said apron to start a progressive laying of said cut lengths on said apron to finally remove said lengths from said feeding means, whereby one row of cut staple fibers overlaps the preceding row by a predetermined distance while maintaining the leading ends of all cut lengths in each row in transverse alignment, and means for changing the said aligned end relation into an axially staggered relation considered lengthwise of the fibers for drawing into a web.

6. An apparatus for preparing staple fibers from continuous length filaments comprising the combination of means for feeding rows of continuous lengths of filaments to a severing point in combination with means for interspersing the respective fibers of successive rows of cut staples with leading ends staggered for drawing into a web, said feeding means comprising a driven wheel, peripherally spaced pin bars forming supports respectively for said filament rows before and after severing, said bars being circumferentially adjustable to provide predetermined staple lengths, a cutting knife,

7

means for synchronously operating said feeding means and said cutting knife, and means between said cutting knife and said interspersing means for automatically successively removing severed staple row lengths and arranging the rows in predetermined overlapped substantially parallel condition for delivery to said interspersing means.

7. The method of forming a web of predetermined staple lengths, which consists in feeding a plurality of respectively multiple filament strands to a severing point, simultaneously cutting said strands into predetermined like lengths of staple fibers in a succession of steps to produce rows of cut staple fibers, the cut staple fibers of each row being of predetermined lengths, supporting each cut row with the staple fibers suspended in parallel relation and with free ends in transverse alignment, progressively laying the free ends of a row on a support at an angle to the suspended body portion while maintaining said end alignment, holding the free

8

ends of the progressively laid lengths, progressively doffing the laid lengths from the suspended position to place one row of like cut staple lengths in parallel predetermined overlapping relation to the preceding row, causing the respective cut fibers of each row to be longitudinally moved relative to adjacent fibers to intersperse to transform the aligned end relation into axially staggered relation, and drawing the interspersed fibers into a web.

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