April 14, 1964 L. E. PEARSON 3,128,507

METHOD OF DEPOSITING FIBERS FROM ONE TOW ONTO ANOTHER TOW INCIDENT TO FORMING A NONWOVEN WEB

Original Filed Jan. 30, 1961 2 Sheets-Sheet 1

FIG. 1

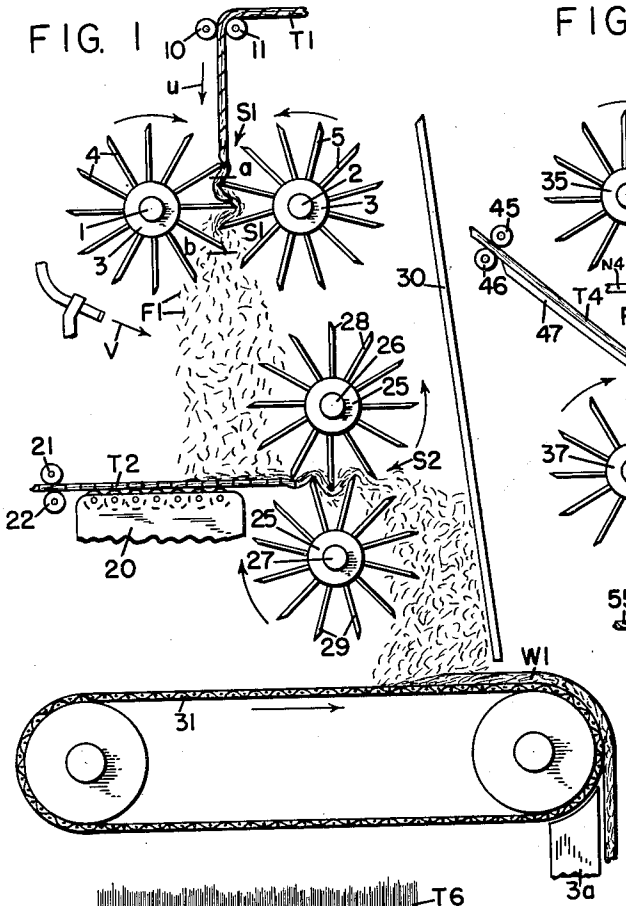



FIG. 2

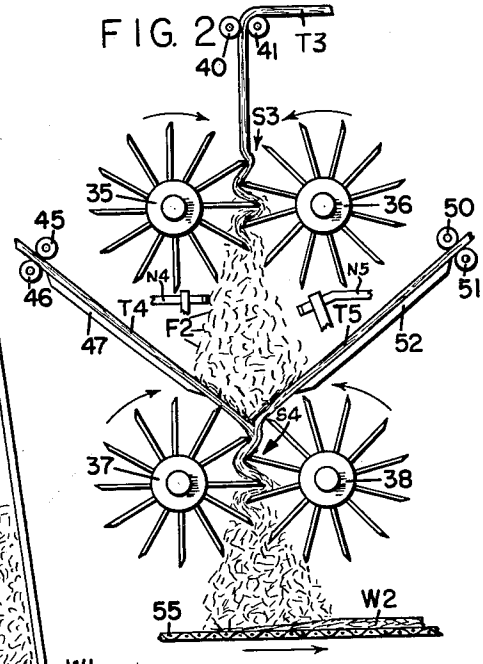
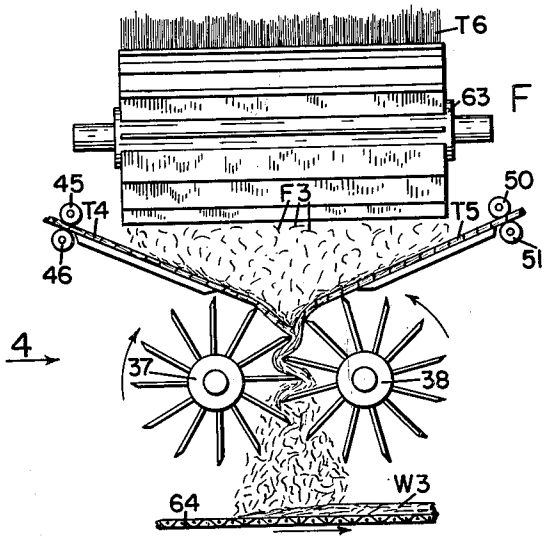



FIG. 3




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FIG. 4

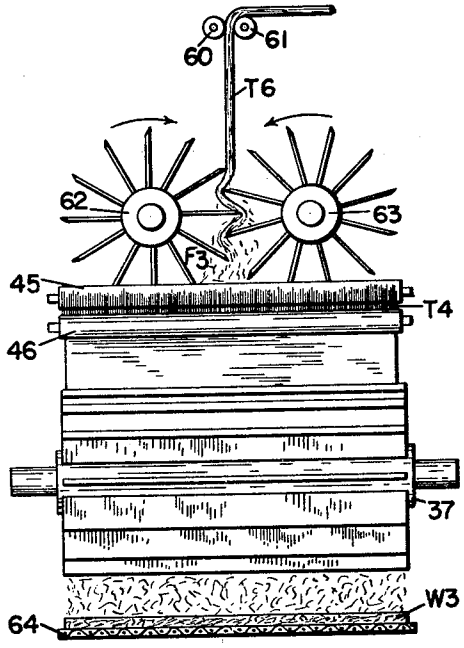
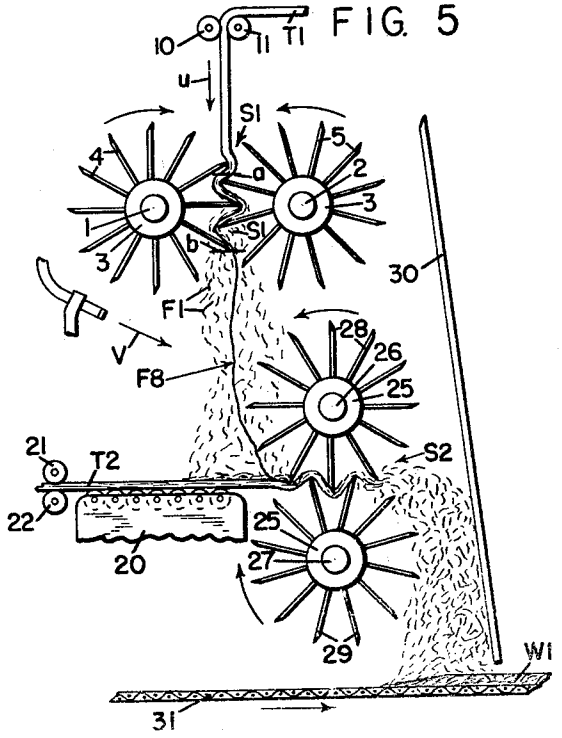



FIG. 5




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# METHOD OF DEPOSITING FIBERS FROM ONE TOW ONTO ANOTHER TOW INCIDENT TO FORMING A NONWOVEN WEB

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Continuation of application Ser. No. 85,592, Jan. 30, 1961. This application Jan. 19, 1962, Ser. No. 167,279
8 Claims. (Cl. 19—155)

This is a continuation of my copending application Serial No. 85,592, filed January 30, 1961 and now abandoned.

This invention relates to a method of making a nonwoven web from two or more tows of filaments and it is the general object of the invention to provide successive stages in the conversion of plural tows into a single web possessed of features characteristic of the features of the tows.

There has recently been proposed a procedure for making a nonwoven web involving the step of passing a tow of filaments through, or at least into, an operating zone where the filaments are subjected to alternate flexing by rotating blades, thereby rupturing the filaments into fibers which then either fall or are blown onto a conveyor to form a web. This procedure has been limited to a single tow, with the result that the web is plain and there is little if any opportunity to introduce variations in the materials of which the web is made.

It is an important object of the invention to provide a procedure by which fibers derived from a plurality of different tows can be incorporated into a single nonwoven web. The method contemplated herein converts one tow to fibers at one station and the fibers thus formed drop or are blown against or onto another tow at random which then passes through a second station. From this process there results a web which is a composite mixture or blend including fibers of one kind produced at the first station mingled with fibers of a different kind produced between a second station. The fibers produced at the first station are free and unattached when they reach the second station and go through the latter whereby breaking of the fibers of the first tow occurs simultaneously with breaking of the filaments of the second tow.

Referring to the drawing which shows diagrammatically three procedures for carrying the present invention into effect,

FIG. 1 shows two pairs of beater blade cylinders and two tows,

FIG. 2 shows two pairs of beater cylinders but with three tows,

FIG. 3 is similar to FIG. 2 except that one of the pairs of cylinders is turned 90° from the position it occupies in FIG. 2,

FIG. 4 is a view looking in the direction of arrow 4, FIG. 3, and

FIG. 5 is a view similar to FIG. 1 showing a filament extending from the first station to the second station for rupturing the filament thereat.

Referring to FIG. 1, an upper pair of beater blade cylinders have parallel horizontally aligned shafts 1 and 2. Each shaft has secured thereto a cylinder 3 to which are secured beater blades, blades 4 corresponding to shaft 1 and blades 5 to shaft 2. The outer edges of the blades are parallel and the blades of one shaft mesh or fit partway into the spaces between the blades of the other shaft. The distance between the parallel axes of shafts 1 and 2 is somewhat less than the diameter across opposite blades of a cylinder to allow for some overlap of the two sets of blades. The paths of the outer edges of the two sets of blades intersect at points *a* and *b*,



FIG. 1, when the cylinders are turned at the same rate but in opposite directions by any convenient driving means (not shown). The overlap of the paths between points *a* and *b* is called herein an operating zone or station S1.

A tow T1 of synthetic textile filaments or material is fed down to the station S1 by feed rolls 10 and 11 and has its lower end flexed to the right and left as shown in FIG. 1 by blades 4 and 5 as the shafts 1 and 2 rotate. The reverse bending of the filaments ruptures them and breaks them into fibers which are blown downwardly partly by the rotation of the blades 4 and 5 and partly by compressed air entering from above.

A second tow T2 slides to the right along a table 20, being advanced by feed rolls 21 and 22. A second pair of cylinders 25 are secured to shafts 26 and 27 which are vertically aligned. This second pair of cylinders is provided with blades 28 and 29 and is the same as the first pair of cylinders described except that they are arranged vertically and turn in such a direction that the overlapping adjacent edges of the blades 28 and 29 move to the right. The overlapping mentioned provides a second operating zone or station S2 which extends horizontally. A baffle 30 serves to deflect downwardly toward a conveyor 31 any fibers which are blown or forced against it due to rotation of cylinders 25.

When the movable parts shown in FIG. 1 are in operation feed rolls 10 and 11 advance tow T1 toward the upper pair of cylinders 3 and the lower end of the tow is drawn into zone or station S1 by blades 4 and 5. Alternate flexing of the filaments in zone S1 results in rupturing them to make fibers of varying lengths up to 6 inches. These fibers are indicated at F1 in FIG. 1. These fibers, completely detached from tow T1, collect in random distribution on the second tow T2 which is advanced along table 20 by feed rolls 21—22. Any fibers F1 which pass through the tow T2 will be on table 20 and be dragged along the under parts of tow T2.

The second tow T2 is drawn into the second zone S2 by the lower pair of cylinders which draw the tow taut and break it into fibers as was tow T1 in zone S1. The fibers F1, being free and not held to their original tow T1, pass through zone S2 simultaneously with tow T2 and are subject to some secondary breaking simultaneously with breaking of tow T2. The fibers derived from tow T2 mix with fibers F1, the latter retaining substantially whatever characteristics they had when broken loose from tow T1. Tows T1 and T2 can be, and preferably are, different as to at least one feature, such as length, color, size, response to heat, or other feature. Both kinds of fibers are directed toward the inclined baffle 30 and guided down onto the conveyor 31, and after being removed by the stripper 3*a* pass to a packing area where the composite web W1 is rolled or folded for further use. The fibers in the web can be different as to features already mentioned so that the web is a composite of various kinds of fibers. Air streams U and V, FIG. 1, show the directions in which air blasts guide the fibers.

The form of the invention shown in FIG. 2 employs two pairs of beater blade cylinders, the upper pair 35 and 36, and also the lower pair 37, 38, having their axes parallel and in horizontal planes. All four cylinders shown in FIG. 2 have parallel axes, and since they are substantially the same as cylinders 3 and associated parts of the first form, a detailed description of them will not be repeated.

Tow T3 is fed down to the upper pair 35, 36 of blade cylinders by feed rolls 40, 41 and passes into and through an operating zone or station S3 to break its filaments into fibers, as already described in connection with FIG. 1.

These fibers are indicated at F2 in FIG. 2 and fall or are blown down randomly onto two other tows T4 and T5.

Tow T4 is advanced by feed rolls 45, 46 and slides over a flat plate 47 which guides the tow toward the lower pair of cylinders 37, 38. Similarly, tow T5 is fed by feed rolls 50, 51 and slides over another plate 52 toward tow T4 and cylinders 37, 38. The lower parts of the two tows merge and pass into and through operating zone S4 to be broken into fibers.

Issuing from zone S4 are fibers from tow T3 and also fibers from tows T4 and T5, and these fibers are deposited on a conveyor 55 to form a web W2. As in the first form, fibers F2 are not materially changed when passing through zone S4 and they blend with the fibers derived from the tows T4 and T5 which travel downwardly and toward each other. The composite web can be composed of three different types of fibers derived from the tows T3, T4 and T5 which may also differ from each other with respect to at least one of the characteristics already mentioned in connection with FIG. 1.

The procedure indicated in FIG. 3 is essentially the same as that described with reference to FIG. 2 except that the axes of the two pairs of blade cylinders are not parallel as in FIG. 2 but at right angles. This relation is true also for the top pair of feed rolls with respect to the lower pairs of feed rolls. The feeders 60, 61 and the beater blade cylinders 62, 63 turn on parallel axes which are substantially parallel to the direction of travel of conveyor 64. The cylinders 37, 38 and tows T4 and T5 are the same as in FIG. 2.

The tow T6 fed by rolls 60, 61 to cylinders 62, 63 is broken by the latter into fibers F3 which fall or are blown onto tows T4 and T5 uniformly, half falling on tow T4 and half on tow T5. As the tows T4 and T5 approach each other the fibers F3 have farther to travel from the point of discharge to the operating zone of cylinders 37, 38 and can therefore spread more evenly across the width of the tows. The blended fibers from the three tows form a composite web W3 somewhat similar to web W2.

Although an important feature of the invention is the possibility of blending diverse tows, it will be understood that all the tows used in any form of the invention can be alike, in which event there will be, in addition to a thorough mixture of fibers in the web, a rate of production higher than now attainable in the method already known for converting a tow into fibers and the latter into a web.

In the second form shown in FIG. 2 the fibers F2 can be directed pneumatically toward one or the other of the tows T4, T5 by one or the other of pair of nozzles N4 and N5 to effect a closer mixture of fibers F2 with the fibers of tow T4 or T5 than with the other. If desired, one of the tows T4 or T5 can be fed at a rate faster than the rate of feed of the other.

Referring to FIG. 5, the structure at both stations will be the same as that shown in FIG. 1 and the operation will also be the same. In the event that a filament such as F8 is not broken into fibers at the first station, it will pass through the second station where it will have a second chance for a rupturing and/or breaking. By thus passing filaments through multiple filament breaking stations, the introduction of excessively long filaments into a web is minimized.



Some parts of the foregoing may be the same as the disclosure in an application Serial No. 35,157 filed by Constantine and Wells, now U.S. Patent No. 3,071,821. The tows can be viscose, rayon, acetate, etc. type of filaments, the rate of feed of the tows can approximate twelve inches per minute, and the speed of the beater blade cylinders can be from 1500 to 2000 r.p.m.

I claim:

1. The method of converting filaments of synthetic material in tow form into a nonwoven web including the following steps: feeding a tow of filaments to an operating station, breaking the filaments into fibers at the station, collecting the fibers on a second tow, passing the second tow and the fibers thereon through a second station to break the filaments of the second tow into fibers and mix the latter with the fibers of the first tow, and thereafter depositing the fibers from both tows on a moving conveyor to produce a composite nonwoven web including fibers corresponding to both tows.

2. The method set forth in claim 1 wherein the second station extends horizontally and forces are applied against the second tow at said second station tending to hold the second tow taut and move it in a generally horizontal direction tending to hold the latter taut.

3. The method of converting filaments of synthetic material in tow form into a nonwoven web including the following steps: feeding a tow of filaments to an operating station, breaking the filaments into fibers at the station, depositing the fibers onto two tows moving along diagonal paths which converge at a second operating station at which the filaments of said two tows are broken into fibers and comingle with the fibers from the first tow, and thereafter depositing all of the fibers on a moving conveyor to form a nonwoven web containing fibers from all three tows.

4. The method set forth in claim 3 wherein at least one of said tows contains filaments of a type different from the type of the other tows.

5. The method set forth in claim 3 wherein one of said two tows contains filaments of a type different from the type of the other of said two tows.

6. The method set forth in claim 3 wherein one of said two tows is fed at a rate faster than the rate of feed of the other of said two tows.

7. The method set forth in claim 3 wherein the fibers derived from the first named tow are directed more predominantly toward one of said two tows than the other of the two tows.

8. The method set forth in claim 3 wherein the fibers from the first tow are deposited at a uniform rate on the two tows.

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