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METHODS OF MANUFACTURING COMPOSITE WEBS FROM TOW

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FIG. 1

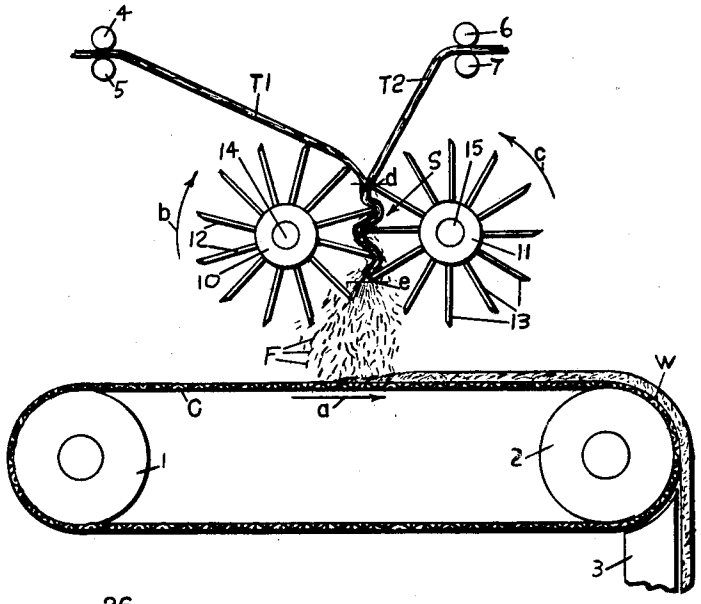
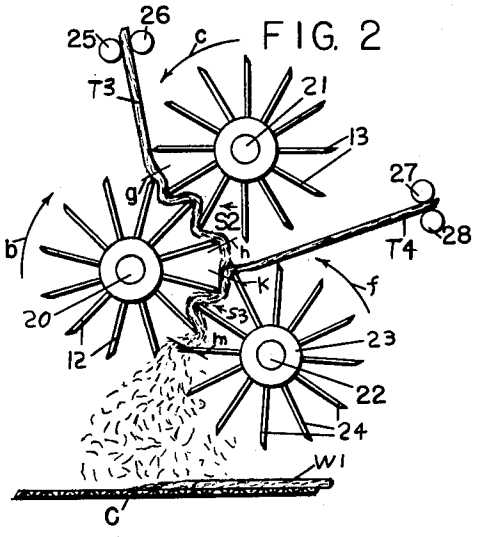


FIG. 2



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METHODS OF MANUFACTURING COMPOSITE WEBS FROM TOW

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This invention relates to a procedure for converting filaments of synthetic material in tow form into a nonwoven web of fibers, and it is the general object of the invention to blend at least two different types of tow to provide a composite web.

Recently there has been proposed a procedure wherein a tow of filaments is fed to an operating zone or station where oppositely rotating sets of blades subject the filaments to alternate deflections, first in one direction and then in the opposite direction. The blades have the effect of breaking or rupturing the filaments into fibers which fall on a conveyor to form a nonwoven web. The procedure described has been limited in its practice to a single tow, all the filaments of which were alike.

It is an important object of the present invention to provide a method by which two or more tows can move to one or more operating stations and be broken into fibers which then collect in mixed or blended order on a conveyor. In one form of the invention two tows are led through a single operating zone or station and in another form one of the tows is fed to two stations while another tow is fed through only one station, the second as shown herein. This latter form permits the use of strong filaments to make binder fibers for the web and weaker filaments to make filler fibers for the web. The strong filaments require more flexing than the weaker ones and are passed through both stations, whereas the weaker filaments are passed through only one station.

It is a further object of the invention to direct a tow toward two sets of rotating beaters in such manner that one set will frictionally engage and stroke or rub along the tow to prepare it for the reverse flexing which it will be subjected to at the station.

In the accompanying drawings, which show two forms of the invention,

FIG. 1 diagrammatically sets forth two tows and beater blades providing a single operating station or zone, and

FIG. 2 diagrammatically sets forth two tows and two operating zones.

Referring to FIG. 1, suitably driven sprockets or the like 1 and 2 drive a conveyor C so that its upper reach moves in the direction of arrow *a*, or to the right. A detaching means 3 effects removal of the web W (to be described) from the conveyor. Feed rolls 4, 5 at the upper left feed a tow T1 downwardly and to the right, and feed rolls 6, 7 feed a tow T2 downwardly and to the left. The pairs (4, 5 and 6, 7) of feed rolls can feed their tows at the same or different rates, depending upon the character of tow desired.

Below the feed rolls are two sets of beater blades rotatable about parallel horizontal axes as shown herein. These sets include cylinders 10 and 11 to which are secured blades 12 and 13 respectively. The blades are preferably equiangularly spaced around their respective cylinders, each cylinder having the same number of blades, the tow engaging edges of which are preferably straight and parallel to each other and notched, if desired.

The distance between the axes of the cylinders is less than the diameter of a set of blades so that there will be a mesh, as it were, with each blade of a set arranged to enter between adjacent blades of the other set, as apparent in FIG. 1. The cylinders 10 and 11, and the shafts

14 and 15 to which they are secured, turn in opposite directions at the same rate, as shown by arrows *b* and *c* respectively. The cylindrical paths traveled by the edges of the blades intersect and between the top and bottom intersections, designated by lines *d* and *e*, lies an operating zone or station S in which the tows are subjected to alternate flexings to the right and left by the blades 12 and 13 as shown in FIG. 1.

When the shafts 14 and 15 are turned in opposite directions and the pairs of rolls 4, 5 and 6, 7 feed their tows T1 and T2, the latter enter the operating zone and remain in the zone long enough so that the filaments between the lines *d* and *e* are subjected to many flexings in the course of which they are broken or ruptured to form fibers F which fall, or are blown down on, or are sucked down on the conveyor to form a web W. As the conveyor continues to move the web reaches the stripper 3 which lifts it from the conveyor, after which it can be led to a point (not shown) where it can be rolled up or folded.

In the process just described filaments of two different kinds are broken into fibers which are then mixed and deposited on the conveyor. This blending of fibers makes possible the production of composite webs having a considerable variety of characteristics. The tows T1 and T2 can, for instance, be of different color, or their filaments of different denier, or of different materials, such as the viscoses, rayons, acetates, etc., or of different responses to heat. These varying properties can be joined as desired to produce many types of web. The tows can be fed at different linear rates to vary the percentage of tow T1 to tow T2 in the web.

In the process illustrated in FIG. 2 one of the tows is passed through two operating zones. In FIG. 2 shafts 20 and 21 correspond respectively to shafts 14 and 15, except that the former shafts are not horizontally aligned but are diagonally disposed. A third shaft 22 is parallel to shafts 20 and 21 and may be disposed as shown in FIG. 2. Shaft 20 may be spaced equally from shafts 21 and 22, but the latter shafts should be spaced apart far enough so their blades will not travel in intersecting paths, and so that tow T4 can pass between them. Tow T3 passes between shafts 20 and 21. Shaft 22 carries a cylinder 23 having blades 24 similar to the blades of shafts 20 and 21, which in turn are like the blades of shafts 14 and 15. The blades 24 mesh with the blades 12 of shaft 20 as do blades 12 and 13 when shaft 22 turns in the direction of arrow *f* and shafts 20 and 21 turn as indicated by arrows *b* and *c*.

The blades 12 and 13 of shafts 20 and 21 travel in intersecting paths between lines *g* and *h*, and blades 12 and 24 travel in intersecting paths between lines *k* and *m*, FIG. 2. An operating zone S2 lies between lines *g*—*h*, and zone S3 lies between lines *k* and *m*.

When the sets of blades are turning as indicated in FIG. 2 tow T3 is fed by feed rolls 25—26 and tow T4 is fed by feed rolls 27—28 either at the same rate as tow T3 is fed, or a different rate. Tow T3 passes through zones S2 and S3, whereas tow T4 moves down from its feed rolls 27—28 between the oppositely moving adjacent edges of blades 13 and 24 and into zone S3. Tow T3 can be made of filaments of such strength that a single operating zone would be insufficient to produce fibers at a desired rate, making a second zone necessary. Tow T4, on the other hand, could consist of filaments having a low resistance to rupture so that passing through a single zone would suffice to produce fibers at a desired rate.

All of the advantages of blending, etc., mentioned in connection with FIG. 1 are present in the form shown in FIG. 2. There will be more filaments in zone S3 than in S2 and it may be desirable for that reason to

have less overlap, or mesh, between blades 12 and 24 than between blades 12 and 13. Tow T3, or some of its filaments, will be in contact with blades 12 from the beginning of zone S2 to the end of zone S3, some of the filaments being broken at zone S2.

It will be understood that in the practice of the invention the two sets of beater blades, and part at least of the tow feed and the conveyor will be associated with an enclosure (not shown) and that a vacuum box under the upper reach of the conveyor will be connected to a fan which is effective to cause a blast of air from above the blades to blow the fibers down against the conveyor.

As shown in FIG. 1, the tow T2 is fed down almost vertically so that it has little or no contact with blades 12 and 13 until it reaches the zone S, but the other tow T1 comes down quite obliquely relative to the horizontal plane of the axes of shafts 14 and 15 and its under side is rubbed or stroked by blades 12 before reaching zone S. The rubbing mentioned conditions the filaments for quicker rupture when they reach the zone S. Each tow is subjected to lengthwise frictional forces on its opposite sides when passing through a station.

From the foregoing it will be seen that the invention sets forth a method whereby the filaments of diverse types of tow can be broken into fibers which are then collected into a non-woven web having different types of fibers incorporated thereinto. If one of the tows has brittle filaments, T2 or T4 for instance, it can be fed at a relatively fast rate, whereas a stronger tow made of tough filaments can be fed either slower to subject it to more flexings, or can be passed through two stations. In the latter instance production can be faster than would be the case if the filaments passed through only one station. When the stronger tow is fed at a slower rate than the brittle tow, it breaks up into relatively long fibers which act to bind the fibers of the brittle tow into the web.

Some parts of the foregoing may be the same as the disclosure in an application, Serial No. 35,157, filed by Constantine and Wells, 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 one type of filaments through two operating stations in each of which some of the filaments are broken off to form fibers, and feeding another tow of a different type of filaments to one only of said stations to break the filaments thereof into fibers, and collecting the fibers formed from both tows onto a moving conveyor to provide a composite nonwoven web containing fibers of two different types.

2. The method of converting filaments of synthetic material in tow form into a nonwoven web including the following steps: feeding two tows of different types of filaments to an operating station, subjecting both tows at said station to alternate flexing in opposite directions to break the filaments into fibers, and depositing the fibers onto a moving conveyor to form a composite nonwoven web containing fibers of two different types, each tow when in said operating station being subjected to rotary frictional forces directed longitudinally thereof on opposite sides thereof, one tow being fed toward said station in a direction substantially at right angles to a horizontal plane passing through the axes of said rotary forces, and the other tow being fed toward said station in a direction oblique to said plane to enable said other tow to be subjected to said frictional forces before entering said station.

3. The method of converting filaments of synthetic material in tow form into a nonwoven web including the following steps: feeding two tows of different types of filaments to an operating station, subjecting both tows at said station to alternate flexing in opposite directions to break the filaments into fibers, and depositing the fibers onto a moving conveyor to form a composite nonwoven web containing fibers of two different types, the filaments of one tow being brittle and fed at a fast rate because they break into fibers easily and the other tow being fed slower because it is stronger and breaks into relatively long fibers which bind the fibers of the first tow into the web.

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