1,060,736

PATENT SPECIFICATION 1,060,736

DRAWINGS ATTACHED.

Date of Application and filing Complete Specification:
Feb. 13, 1964. *No. 6026/64.*

Application made in United States of America (No. 259,852) on Feb. 20, 1963.

Complete Specification Published: March 8, 1967.

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Index at Acceptance:—D1 FX; D1 D(2A1C, 2A5D, 2A5E).

Int. Cl.:—D 01 b /D 01 h.

COMPLETE SPECIFICATION.

Treatment of Crimped Continuous Filament Tow.

We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester 4, New York, United States of America (Assignees of THEODORE CALVIN FRITZ) do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the treatment of crimped continuous filament tow, more particularly for use in the manufacture of tobacco smoke filters.

Various methods have previously been proposed for the treatment of crimped tobacco smoke filter tow by a series of steps generally consisting of banding, tensioning, relaxing and plasticizing the tow to convert it into a form which when compacted into tobacco smoke filter rods exhibits a capability of removing undesirable impurities from the smoke stream with a minimum of fluid flow resistance and permits maximum contact of the fluid stream with the tow, thereby enhancing efficiency. Such methods as these have proved highly useful to the tobacco smoke filter trade. However, in general they have either involved a striker and anvil arrangement for imparting and releasing an increment of tension or two pairs of treating rollers, for example, a set of pulling or tension rollers downstream from a set of retarded or holding-back rollers.

In accordance with the present invention there is provided a process for treating crimped continuous filament tow to displace filaments of the tow relative to others in a longitudinal direction, comprising passing the tow between a pair of coacting rollers, at least one of which has a surface configuration consisting of a series of smooth-surfaced substantially flat valleys between elevated portions extending circumferentially around the surface of the roller and parallel to the edge of the roller.

According to the present invention there is also provided blooming apparatus for crimped filter tow comprising means for spreading the tow into a flat band, means for tensioning the spread filaments to remove temporarily the crimps and a pair of coacting rollers for longitudinally displacing some of the filaments relative to the others, at least one of the coacting rollers having a surface configuration consisting of a series of smooth-surfaced substantially flat valleys between elevated portions extending circumferentially around the surface of the roller and parallel to the edge of the roller.

In the accompanying drawing:

Fig. 1 is a schematic diagram of the apparatus constructed in accordance with the present invention for differentially blooming continuous-filament tobacco smoke filter tow;

Fig. 2 is a perspective view of a groove and ridge roller surface embodiment of a feed roller which may be used in the present invention;

Fig. 3 is a transverse cross section, to an enlarged scale, through any point of the groove and ridge portion of the roller of Fig. 2;

Fig. 4 is a schematic diagram of an alternative embodiment of the apparatus in accordance with the present invention for differentially blooming tow;

Fig. 5 is a perspective view of a differential belt representative of the type of belt which may be used in co-operation with the feed rollers;

Figs. 6 and 7 are perspective views of roller having other surface patterns which may be used;

Figs. 8 to 11 depict schematically the tensioning and relaxing of the tow in small groups of filaments as it takes place according to the process of this invention.

Terms such as "upper", "lower", "above", "below", "horizontal", and the like are used to describe apparatus illustrated in the drawings and disclosed herein. However, it will be understood that these terms are used in fact merely for convenience of description and are by no means critical, and that the same apparatus will be operative to perform its function whether in the described position or disposed vertically or obliquely, or turned on its side.

Referring first to Fig. 1, cellulose acetate crimped tow is withdrawn from bale 10 and passed through a banding device 12 of any known type. The banding device momentarily spreads out the filaments as the tow passes over a roller guide 14. The tow remains spread out as it leaves the roller guide surface and continues on to a tensioning device 16 comprising a pair of pneumatic loaded rollers which retard the tow on its way to a pair of feed rollers 18. This retarding action provided by the rollers 16 tensions the tow just enough to straighten out the crimp so that a uniform length of tow is presented to the feed rollers 18, one or both of which is configured as hereinafter described. The feed rollers 18 are in a light nip or contact and rotate at different speeds. The tow emerges in bloomed form. These rollers 18 as well as the rollers 16 and downstream delivery rollers 20 are mounted for variable positioning so that the pressure of the ~~bit~~ bite between the rollers may be varied. The tow is next fed over delivery rollers 20 at which point plasticizer may be added to both surfaces thereof by applying plasticizer to the roller surfaces from wick applicators 22. The tow then moves through a collecting trumpet 24, and finally into a rod maker 26 of any known type where it is covered with wrapping material and cut to the proper length to form a filter rod. In an alternative manner, plasticizer may be added from a spray booth (not shown) positioned between feed rollers 18 and delivery rollers 20.

Figs. 2 and 3 show one form of surface configuration which may be used for one or both of the pair of rollers 18. As shown, the surface of the roller has a series of smooth-surfaced substantially flat valleys between elevated portions extending ~~circumferential~~ circumferentially around the surface of, and parallel to the edge of, the roller. Each valley is continuous and the elevated portions have smooth surfaces for contacting tow, thereby obviating breaking or otherwise damaging the filaments.

If desired, one of the pair of rollers 16 may also have a surface configuration as shown in Figs. 2 and 3. In such a case only the roller 18 which is disposed on the opposite surface of the tow from that contacted by the configured roller 16 need be configured.

Fig. 4 represents an alternative method of carrying out the present invention. In this embodiment like numbers are used to refer to similar parts of Fig. 1. The banded tow is received from a roller guide not shown and passed on into pre-tension rollers 16. From this retarding action a uniform length of crimped tow is fed by a belt 30 between configured roller 18*a* and differentially driven roller 18*b*. Belt 30 is maintained in its proper running position by means of an adjusting idler roller 32, and the contact area indicated by "A" is the enlarged treatment or contact area resulting from use of differentially driven roller 18*b*. The bloomed tow is then fed to a suitable plasticizer applicator and on to the rod maker as in Fig. 1.

Fig. 5 represents a belt 30 which may be used in the process depicted in Fig. 4. This belt may be of woven endless cloth 8" wide and 50" long. If desired, a plastic material, such as polyethylene, may be used instead of cloth.

The rollers 18 or 18*a* may be of such materials as steel, rubber, nylon or may be covered with woven fabric. A design such as that of Fig. 2 may sometimes be helpful in enhancing the blooming of the tow. It is also possible by variation of the number or location of rollers and of surfaces of pretensioning rollers to increase the degree of blooming. The tow may be presented to a differential speed work area in the particular condition desired for the specific end use. For instance, instead of only one set of rollers and belts, a combination employing several rollers and belts may be used to accomplish multiple blooming.

Fig. 6 shows a modified roller surface configuration for one or both of the rollers 18 and/or 16, comprising rows of notchlike indentations or slits, each row being substantially parallel to the edge or end of the roller, thus achieving what may be described in one way as a vibratory effect when tow is passed over the surface of the roller.

Fig. 7 shows a further modified roller surface configuration, that is, a surface having alternating non-configured and configured portions going all the way round the roller, in this particular instance the configured portions having parallel ridges and valleys surrounding the roller and directed in its direction of turn, that is, parallel to its edge or end.

In the method according to the present invention, the filaments are treated in small groups as shown in Figs. 8—11. Some groups of filaments are tensioned while at

the same instant adjacent groups of filaments are not tensioned. The bloom or opening action in a group of filaments differs from the action of the previously proposed process in that a group of tensioned filaments is displaced relative to the adjacent groups of untensioned filaments by at least a small amount, thus aiding filament separation. Thus group (a) of Fig. 8 may not be exactly the same as group (a^1) of Fig. 9, which again may differ slightly from (a^{11}), Fig. 10.

Groups *b*, *c*, *d* and *e* may vary in a similar manner. The net result of the roller-opening according to the present invention may be somewhat as illustrated diagrammatically in Fig. 11, where each filament is positioned in a random relationship with respect to adjacent filaments. The filaments do not appear to be straightened out to the extent that they are when the entire filament bundle is tensioned and relaxed simultaneously according to prior art blooming techniques.

In an alternative embodiment of the invention, in addition to passing between feed rollers 18 of Fig. 1 or over the belt-roller arrangement of Fig. 3, the tow may be passed before rollers 16 and after feed rollers 18 or belt-roller 30 treatment through a tension-bar or friction device zone 32^1 as shown in Fig. 1. By passage through such an arrangement, a differential tensional drag is applied to closely adjacent increments of the banded tow. The zone consists of a fixed ladder-type tension device with fingers having alternate bands of high and low friction surfaces. Such a snubbing arrangement tends to aid in the longitudinal blooming effect brought about according to the present invention. The tow passes alternately over and under tension bars. The bars are fabricated so as to have 1/10 to 1/16 inch wide increments of high and low friction rings, the low rings being turned down to a slightly smaller diameter than that of the bar proper. If desired, only one zone may be employed.

WHAT WE CLAIM IS:—

1. Process for treating crimped continuous filament tow to displace filaments of the tow relative to others in a longitudinal direction, comprising passing the tow between a pair of coacting rollers, at least one of which has a surface configuration consisting of a series of smooth-surfaced substantially flat valleys between elevated portions extending circumferentially around the surface of the roller and parallel to the edge of the roller.

2. Process according to claim 1, wherein the coacting rollers are driven at different peripheral rates of speed.

3. Process according to claim 1 or 2, wherein the displacement is effected by displacing the top and bottom layers of filaments relative to each other and to the middle layer.

4. Process according to claim 1, 2 or 3, wherein the tow is spread and tensioned prior to longitudinal displacement.

5. Process according to any of the preceding claims, wherein the tow is a cellulose ester tow.

6. Blooming apparatus for crimped filter tow comprising means for spreading the tow into a flat band, means for tensioning the spread filaments to remove temporarily the crimps and a pair of coacting rollers for longitudinally displacing some of the filaments relative to the others, at least one of the coacting rollers having a surface configuration consisting of a series of smooth-surfaced substantially flat valleys between elevated portions extending circumferentially around the surface of the roller and parallel to the edge of the roller.

7. Blooming apparatus according to claim 6, wherein the coacting rollers are driven at different peripheral rates of speed.

8. Blooming apparatus according to claim 7, wherein an idler roller is coupled to one of the coacting rollers by means of an endless belt and is located so as to urge the belt into contact with the configured surface of the other coacting roller.

9. Blooming apparatus according to claim 6, 7 or 8, wherein a pair of delivery rollers is located on the downstream side of the pair of coacting rollers with respect to movement of the tow and a wick applicator is located adjacent the surface of each roller of the pair of delivery rollers to apply plasticizer to the surface of each roller.

10. Blooming apparatus according to any one of the preceding claims 6 to 9, wherein a plurality of bars every one of which is offset with respect to the preceding and/or following bars is located upstream from and/or downstream from the coacting rollers with respect to the direction of movement of tow whereby friction is applied to tow moving alternately over one and under the next in order of said plurality of bars.

11. Process for treating crimped continuous filament tow according to claim 1 and as hereinbefore described.

12. Blooming apparatus for crimped filter tow, constructed and adapted to operate as hereinbefore described with reference to, and as shown in, Figs. 1 to 7 of the accompanying drawings.

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Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1967.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

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2. Process according to claim 1, wherein the coacting rollers are driven at different peripheral rates of speed.

3. Process according to claim 1 or 2, wherein the displacement is effected by displacing the top and bottom layers of filaments relative to each other and to the middle layer.

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