

Dec. 19, 1961

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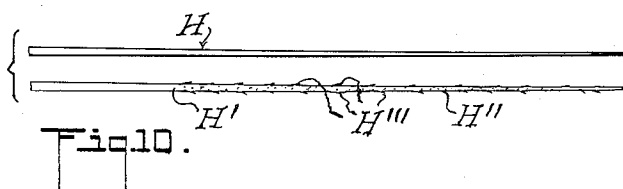
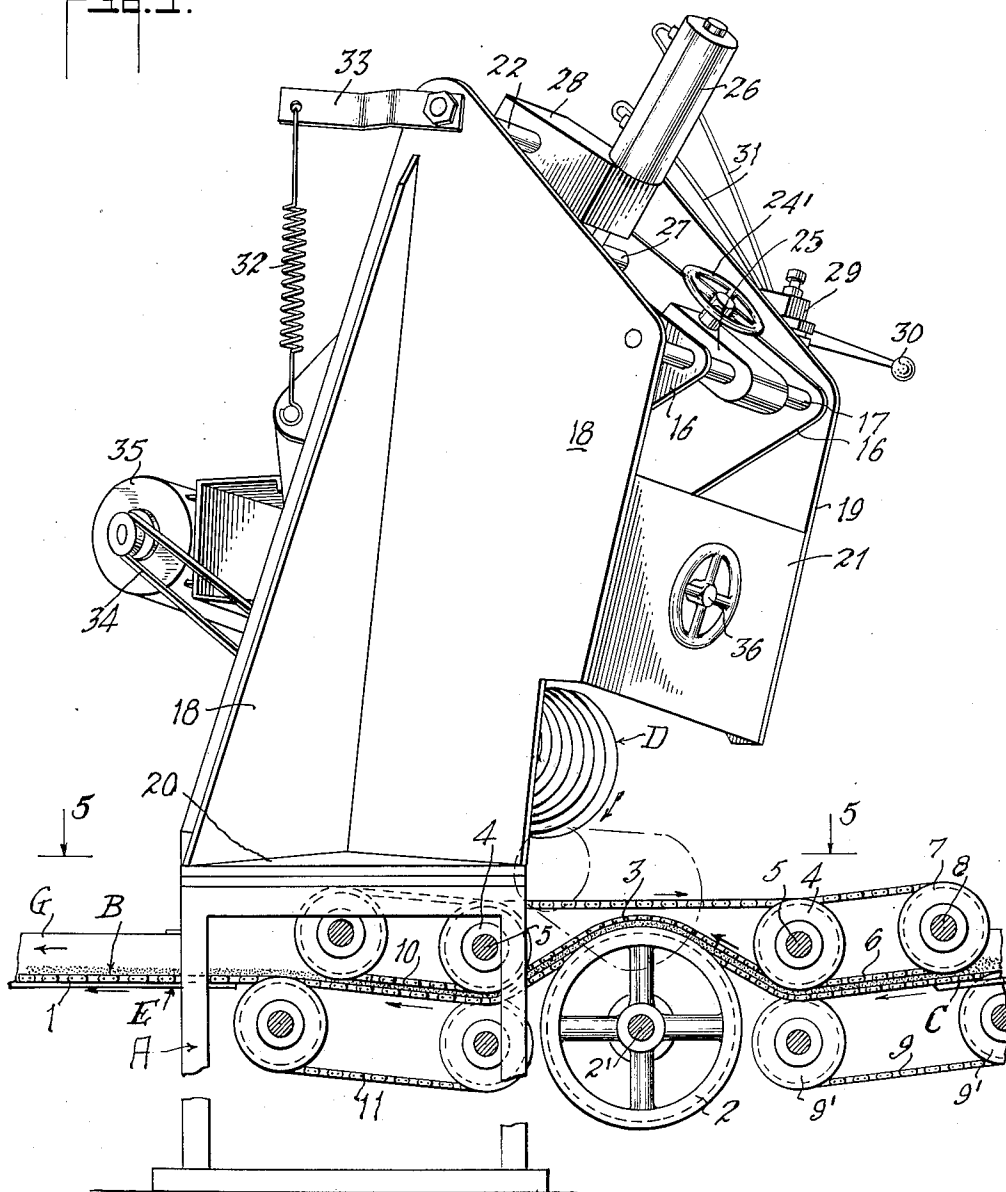
3,013,364

APPARATUS FOR ROUGHENING AND SPURRING ARTIFICIAL FILAMENTS

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4 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

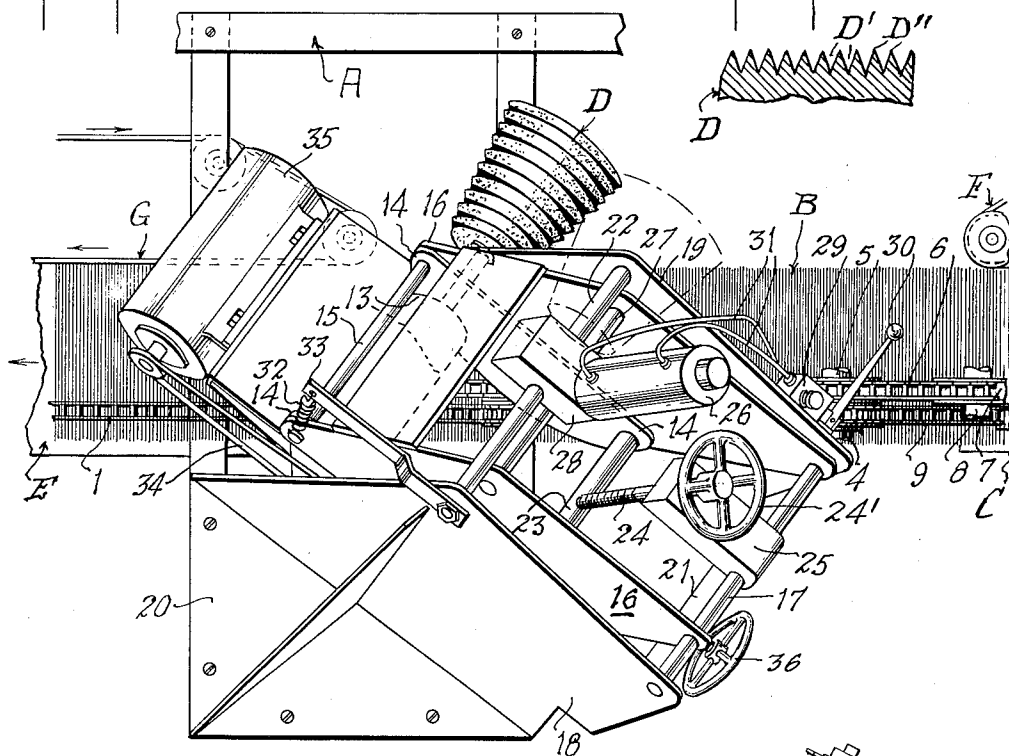


Fig. 9.
 $D' D''$



Fig. 3.

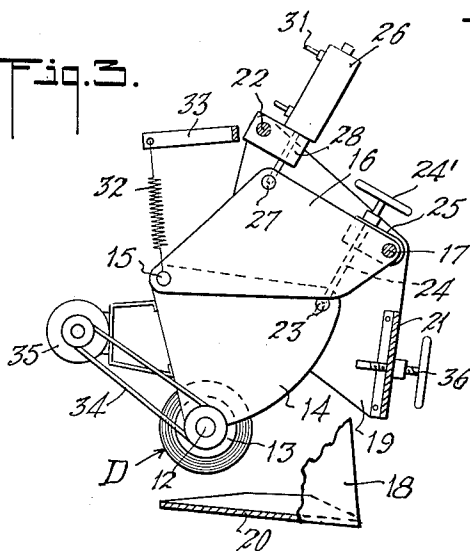
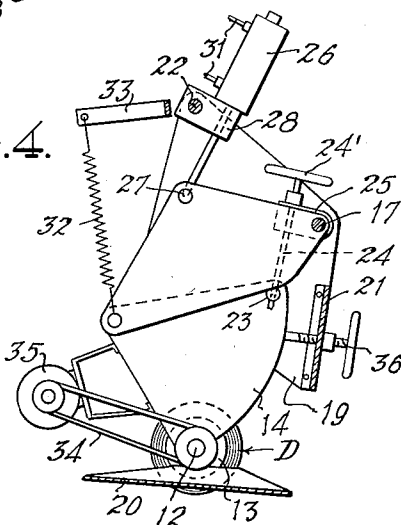


Fig. 4.



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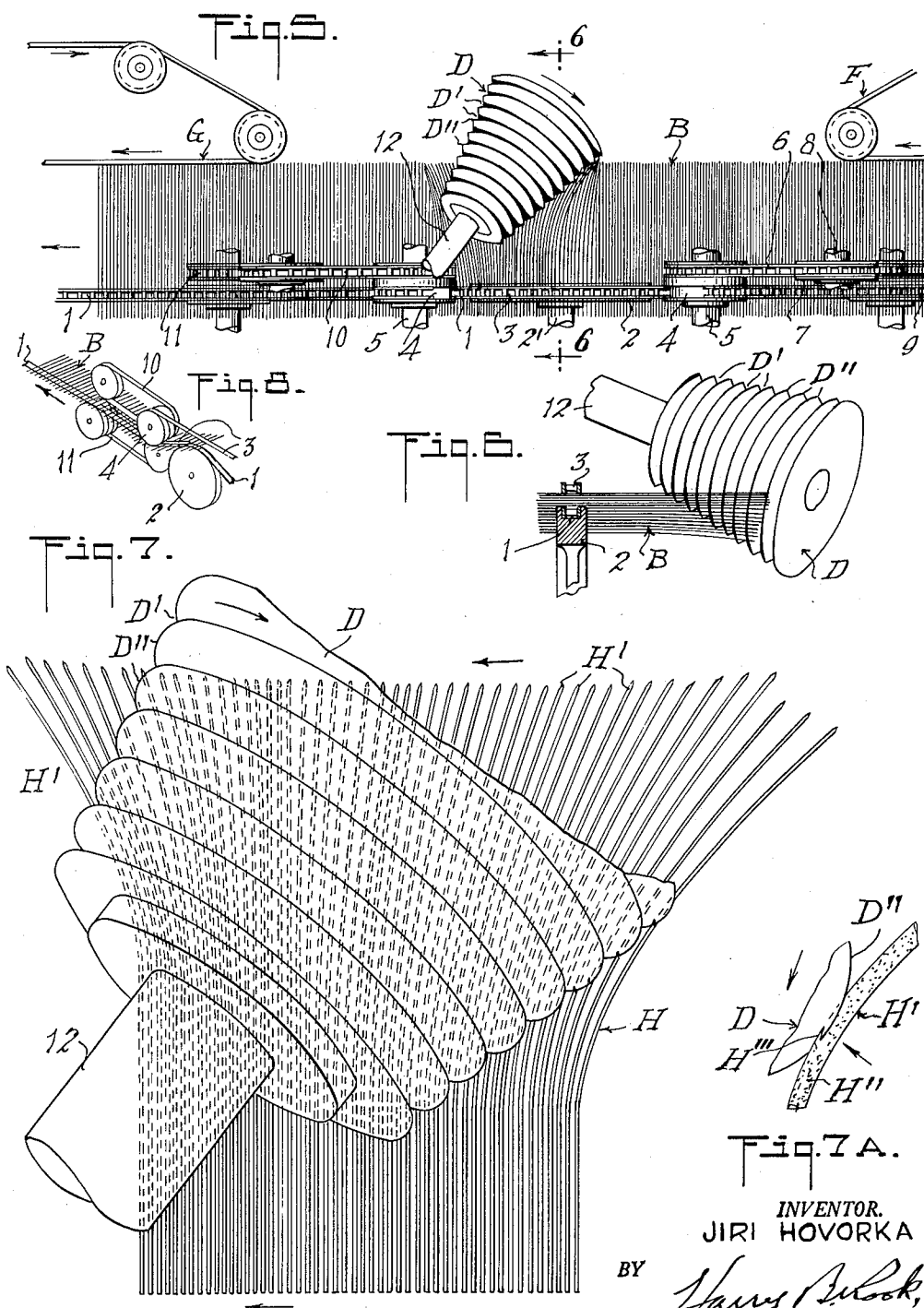
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APPARATUS FOR ROUGHENING AND SPURRING ARTIFICIAL FILAMENTS

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Fig. 11.

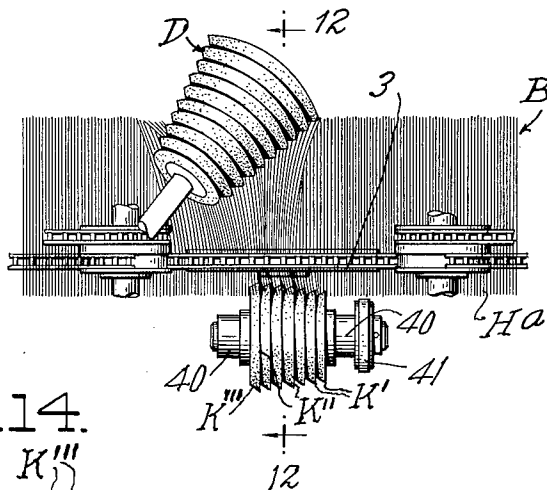


Fig. 14.

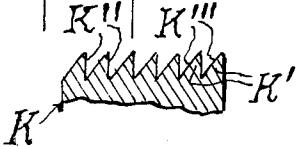


Fig. 12.

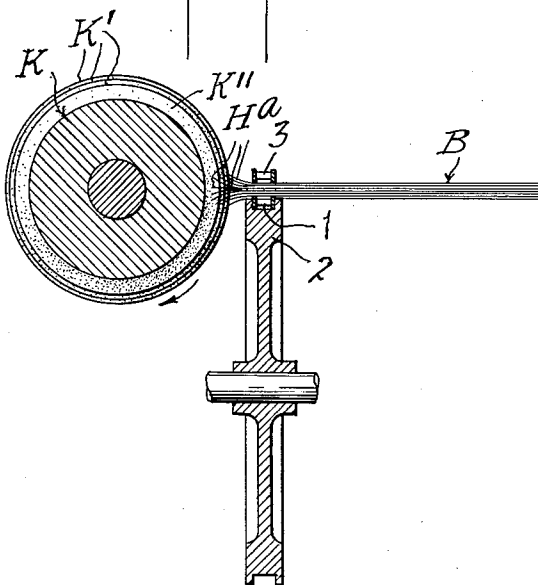
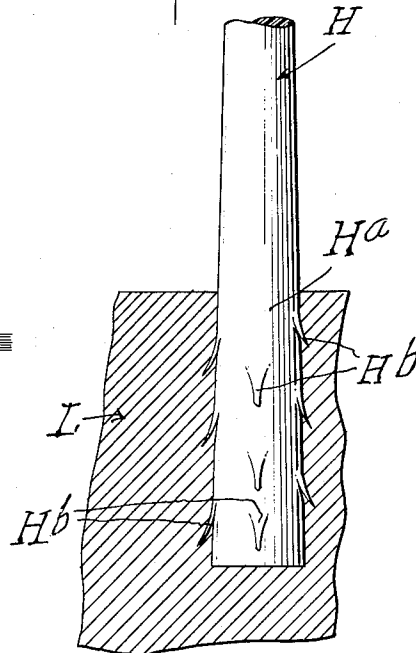


Fig. 13.



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APPARATUS FOR ROUGHENING AND SPURRING ARTIFICIAL FILAMENTS

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10 Claims. (Cl. 51-76)

This invention relates to the roughening of artificial filaments, and particularly filaments employed as synthetic bristles in the manufacture of brushes.

Due to the difficulty in obtaining hog bristles, synthetic bristles or filaments made from resinous materials such as synthetic linear fiber forming polyamides (nylon), have been extensively used in the past few years in the manufacture of paint brushes. However, such synthetic filaments have not been wholly satisfactory because their surfaces are so smooth and glossy that they do not "pick up" as much liquids, such as paints or varnishes, as do natural bristles and do not produce as smooth a finish. Attempts that have been made to overcome these defects, such as by splitting or "flagging" the ends of the filaments and by sanding and tapering the end portions or tips of the filaments, have failed to satisfactorily solve the problem of providing a synthetic bristle or filament that is comparable to the natural bristles.

Furthermore, the difficulty is encountered in firmly securing the other ends of the filaments in the setting material in brushes due to the smooth and glossy surfaces on the filaments, which problem does not exist with natural bristles that have small protuberances at their root or butt ends.

One object of the invention is to provide a novel and improved method and apparatus for treating the ends of synthetic filaments so that the "flag" end portions thereof that normally carry and spread liquids such as paint and varnish shall more readily pick up and retain liquids, and the other or butt ends of the filaments shall firmly interlock with the setting material in brushes whereby the filaments shall be firmly held in the setting material and thereby improve the quality of the brushes.

Another object is to provide a novel and improved method of treating synthetic filaments so that the end portions of the filaments shall be roughened and spurs or burrs shall be formed thereon.

A further object is to provide an apparatus of this character wherein a layer of bristles are conveyed between two conveyor chains with the ends of the bristles projecting beyond the conveyor, and the projecting and unsupported ends of the bristles are moved into contact with the circumferentially grooved peripheral surface of a rapidly rotatable roughening and spurring element so that the projecting ends of the bristles are flexed and pressed under their own inherent resiliency against the surface of said roughening and spurring element and the surfaces of the filaments are roughened and spurred, all without any danger of excessive heating or fusing of the filaments.

It is another object of the invention to provide in such a machine a roughening and spurring element that shall be mounted to rotate rapidly on an axis that is disposed obliquely, both horizontally and vertically with respect to the projecting ends of the filaments, and the roughening and spurring element shall be conical and have an abrasive peripheral surface formed with alternately disposed V-shaped circumferential grooves and ribs spaced apart longitudinally of the element.

Still another object of the invention is to provide novel and improved mounting, driving and adjusting means for a roughening and spurring element of the character de-

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scribed to provide for varying degrees of contact between the element and the bristles and to accommodate bristles of different diameters and lengths.

Other objects, advantages, and results of the invention will be brought out by the following description in conjunction with the accompanying drawings in which:

FIGURE 1 is a side elevation of the apparatus embodying the invention;

FIGURE 2 is a top plan view thereof;

FIGURE 3 is a schematic side elevation of the mounting, driving and adjustable means for the roughening and spurring element with portions omitted for clearness in illustration and showing the element in its normal elevated position above the layer of bristles;

FIGURE 4 is a similar view showing the element in operative position for contact with a layer of bristles;

FIGURE 5 is a schematic fragmentary horizontal plan view approximately on the plane of the line 5-5 of FIGURE 1, but showing the roughening and spurring element in its operative position as indicated by broken lines in FIGURE 1;

FIGURE 6 is a slightly enlarged fragmentary transverse vertical sectional view approximately on the plane of the line 6-6 of FIGURE 5;

FIGURE 7 is a greatly enlarged fragmentary top plan view of the roughening and spurring element and some bristles, showing the manner in which the bristles are flexed by contact with said element;

FIGURE 7A is a fragmentary schematic perspective view of a portion of a bristle being roughened and spurred by the roughening and spurring element, the showing being exaggerated for clearness of illustration;

FIGURE 8 is a schematic perspective view of a portion of the bristle conveyor system, illustrated on a greatly reduced scale;

FIGURE 9 is a fragmentary longitudinal vertical sectional view through a portion of the roughening and spurring element showing the preferred shape of the ribs and grooves;

FIGURE 10 is an enlarged composite elevational view showing an untreated filament and a treated filament;

FIGURE 11 is a schematic top plan view similar to FIGURE 5 illustrating the step of the method and the roughening element for spurring or burring the butt ends of the filaments;

FIGURE 12 is a view similar to FIGURE 6 taken on the plane of the line 12-12 of FIGURE 11;

FIGURE 13 is a greatly enlarged schematic side elevational view of the butt end of a treated filament embedded in a setting material or cement that is illustrated in transverse section; and

FIGURE 14 is a view similar to FIGURE 9 illustrating the roughening and spurring element for the butt ends of the filaments.

Specifically describing the illustrated embodiment of the invention and referring particularly to FIGURES 1 and 2, reference character A designates the main frame of the machine, portions of which have been omitted for clearness of illustration, but upon which is journaled a conveyor system for the layer or mat of filaments B of generally known construction. As shown, this conveyor system includes a feed chute or table C from which the mat of filaments is fed to the conveyor chains that includes an endless chain 1 only a portion of which is shown and which passes over a wheel 2 and between which and the lower reach of a conveyor chain 3 the butt end portions of the filaments are gripped and the tip ends of the filaments are carried or conveyed into contact with and past a bristle roughening and spurring element D. The conveyor chains run around pulleys 4 that are mounted on shafts 5 journaled in the machine frame. The main

chain 1 also cooperates with the lower reach of a take-on chain 6 to receive the filament mat from the feed table C. The chain 6 is shown as running around the pulley 5 and another pulley 7 that is mounted on a shaft 8 journaled in the frame. Cooperating with the chains 1 and 6 in known manner is the upper reach of another endless chain 9 mounted on pulleys 9' for accurately arranging and conveying the mat of filaments from the feed table to the wheel 2 which is carried by the shaft 2' that is parallel to shafts 5. The filament mat is received from the wheel 2 between the main chain 1 and take-off chains 10 and 11 corresponding to the take-on chains 6 and 9, the filament mat being conveyed to a discharge table E in the usual manner. Endless belt conveyors F and G are provided at opposite sides of the roughening and spurring element D, and the tip or flag ends of the bristles abut the reaches of said conveyors that move in the direction of movement of the main conveyor chain 1 as indicated by the arrows in FIGURES 1 and 2. With this construction, the filaments are firmly and accurately guided to and from the wheel 2 and the major portions of the lengths of the filaments project from and are exposed at one side of the wheel 2 for roughening and spurring by the element D as best shown in FIGURE 5.

The roughening and spurring element D is shown as frusto-conical in shape and formed of a suitable abrasive material such as Carborundum; and the peripheral or circumferential surface of the element is circumferentially grooved. Preferably the peripheral surface of the element is formed with alternate V-shaped grooves D' and ribs or ridges D'' that are closely spaced longitudinally of the element as best shown in FIGURE 9. The element D is mounted for rapid rotation about its axis, for example, at a speed of the order of 2,000 r.p.m., and the axis of the element is preferably disposed obliquely to the axis of the filaments both vertically and horizontally as best shown in FIGURES 5 and 6. It is desirable that the axis of the element be disposed at an angle of the order of 35° to 55° to the direction of movement of the main conveyor chain 1 and the mat of filaments as shown in FIGURE 5, and said axis is also preferably inclined at an angle of the order of 15° to the general plane of movement of the main chain 1 and the filament mat as shown in FIGURE 6.

The roughening and spurring element is mounted with its larger end disposed outwardly beyond the tip or flag ends of the filaments and its smaller end disposed intermediate the length of the filaments adjacent the main conveyor chain 1 and facing toward the leading end of said conveyor as shown in FIGURES 5 and 6; and the element D is juxtaposed to the portion of the wheel 2 over which the conveyor passes and normally above the path of movement of the filament mat as shown by solid lines in FIGURES 1 and 2 and is movable at the will of the operator into the path of movement of the mat as shown by dot and dash lines in FIGURES 1 and 2 and by solid lines in FIGURES 5, 6, and 7 so that as the filaments are moved by the conveyor 1 over the wheel 2, the filaments are pressed under their own inherent resiliency against the peripheral surface of the roughening and spurring element as best shown in FIGURES 5, 6, and 7. It will be understood that the conveyor chains 1, 3, 6, 9, 10, and 11 will be power driven in any suitable known manner. The element D normally rotates at its high speed in the direction of the arrow in FIGURE 5 which corresponds to the direction of linear movement of the main conveyor chain 1 and the filament mat, and as the filaments have beneath the element D their surfaces are roughened by the element and tiny spurs are formed on the filament as best shown in FIGURE 10 where an untreated filament is designated H and a treated filament is designated H'. The latter has its tapered flag end portion roughened as indicated at H'' and formed with spurs or barbs H''' that point toward the tip or flag end of the filament. Desirably the filaments are passed into contact with the element D two or more times in order to insure a roughening and spurring

of the filament throughout its circumferential surface. It has been found that this roughening, spurring or barbing operation may be performed without danger of excessive heating or fusing of synthetic resinous filaments such as nylon, probably due to the rotation of the element D in the same direction as the linear movement of the filament mat, the high speed of revolution of the element, the circumferential ribs in the surface of the element and the relatively light contact of the filaments with the element under their own inherent resiliency. It will be observed that the compound angular relation of the element D relative to the filaments causes the ribs to exert a cutting or nicking action in the direction of the butt ends of the filaments so that the spurs or barbs H''' point or face toward the flag ends of the filaments as shown in FIGURE 10. FIGURE 7A shows schematically the formation of the spurs.

A filament having the roughened and spurred surface as described will "pick up" and retain liquids such as paint and varnish much more effectively than an untreated filament and practically as effectively as natural bristles so that the filaments will carry adequate liquid for each dip into the liquid adequate to cover a large area of surface, and the tapered and spurred ends of the filaments spread the liquid smoothly and with a minimum of bristle marks.

The now preferred mounting, driving and adjusting means for the roughening and spurring element is shown in FIGURES 1 to 4 inclusive and includes a shaft 12 on which the element D is coaxially mounted and which is journaled in a long bearing 13 that is mounted by and carried between two plates 14 that are pivotally connected at 15 to plates 16 which are in turn mounted on a pivot rod 17 which is journaled in the side pieces 18 and 19 of a super frame that includes a bed plate 20 which is rigidly mounted on the main frame A and to which the side piece 18 is rigidly secured, the side piece 19 being rigidly mounted on the side piece 18 by a cross plate 21 and a tie rod 22. The plates 14 are connected by a tie rod 23 through which is screwed an adjusting rod 24 that passes loosely through a bracket block 25 secured on the cross rod 17 and has a hand wheel 24' at its upper end, so that upon rotation of the hand wheel 24' in the proper directions, the plates 14 may be swung about the pivot 15 to adjust the normal position of the element D, as best shown in FIGURES 3 and 4.

The element D is moved between its upper and lower positions by a fluid pressure cylinder and piston device 26 the piston rod of which is connected to a cross rod 27 that connects the two plates 16 and is slidable through an opening in a bracket block 28 mounted on the tie rod 22. Fluid under pressure is supplied to the device 26 at opposite sides of the piston by a valve 29 operated by a hand lever 30, the valve controlling the flow of fluid under pressure from a source of supply to and from the device 26 through tubes 31, in known manner. Preferably a portion of the combined weight of the plates 14, 16 and the element D, is counterbalanced by a tension spring 32 connected between the rod 15 and a bracket 33 on the super frame. Downward movement of the element D is limited by abutment of the edge of one of the plates 14 with a stop screw 36 that is mounted in the cross plate 21.

The element D is driven through a belt and pulley connection 34 by an electric motor 35 that is mounted on the super frame and is controlled in any suitable manner as by a manual switch.

With this construction, it will be observed that the element D normally will be held in its uppermost position above the path of movement of the filament mat as shown by solid lines in FIGURES 1, 2, and 3, and when it is desired to treat the filaments in the mat, the valve lever 30 is operated to cause actuation of the device 26 so as to swing the plates 16 and 14 downwardly and thus move the element D into its lowermost position as shown by the dot and dash lines in

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FIGURES 1 and 2 and by solid lines in FIGURE 4. It should be noted that a portion of the bed plate 20 is shown in FIGURES 3 and 4 simply as a reference line for indicating the upper and lower positions of the element D.

As hereinbefore indicated, the invention also contemplates the treatment of the end portions of the filaments that are utilized for setting the filaments in a brush, these end portions commonly being called the butt ends, and FIGURES 11 and 12 schematically illustrate the method and apparatus for treating the butt end portions of the filaments. The mat B of bristles is gripped between the two holding and conveying chains 1 and 3 shown in FIGURES 1 through 6 inclusive. The chains move the mat in the direction of the arrow shown in FIGURE 11 so as to draw the butt end portions Ha against or into contact with the periphery of a roughening element K that is preferably frusto-conical in shape and formed of suitable abrasive material such as Carborundum and has its peripheral or circumferential surface provided with a plurality of ridges K', one side K'' of each of which is disposed in a plane approximately perpendicular to the axis of the element, while the other side K''' of each ridge is inclined to the first-mentioned side and to the axis of the element.

The element K is mounted in suitable bearings 40 for rapid rotation by a suitable belt and pulley drive 41 about its axis, for example, at a speed of the order of 2,000 r.p.m., and the axis of the element is angularly disposed with respect to the axes of the filaments so that the planes of the sides K'' of the ridges K' are approximately parallel with the axes of the filaments as shown in FIGURE 11. While the relation of the axis of the element to the plane of movement of the mat may be varied, it is desirable that the axis be approximately parallel to the plane of the movement as shown and with an axial plane of the element approximately coincident with the general plane of the mat as shown in FIGURE 12. The roughening element K is also preferably arranged with the sides K'' of the ridges facing opposite to the direction of movement of the mat as shown in FIGURE 11, and the element is rotated in the direction of the arrow of FIGURE 12.

With this construction, the ridges K' of the roughening element form spurs or burrs Hb on the butt end portions of the filament as best shown in FIGURE 13, and the spurs or burrs provide a secure bond of the filaments with the setting material of a brush as schematically shown in FIGURE 13 where a portion of the setting material is designated L. It will be observed that the spurs or burrs will positively prevent the filaments from being pulled out of the setting material as the latter has once set in a brush ferrule.

It will be understood by those skilled in the art that while the now preferred embodiment of the invention has been shown and described, the structural details of the apparatus and the steps of the method may be modified and changed within the spirit and scope of the invention.

What I claim is:

1. Apparatus for roughening smooth, resilient filaments, comprising means for holding a plurality of the filaments in an elongated mat formation at a zone intermediate the ends of the filaments and with one end of each filament substantially in line at one longitudinal edge of the mat with the corresponding ends of the other filaments, said means being movable to convey the mat longitudinally and the filaments laterally, a roughening element having a plurality of parallel abrasive ribs equidistantly spaced along a common axis and gradually decreasing in diameter from one end to the other of said element, and means mounting said element with its smaller end extending toward the leading end of said mat holding means and with said axis angularly disposed with respect to the filaments, means cooperative with the last-named means for moving said element selectively

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into and out of the path of movement of said mat to cause and to interrupt contact of the filaments with said ribs of said element, respectively, and means for rapidly rotating said element about its axis.

2. Apparatus for roughening smooth, resilient filaments, comprising means for holding a plurality of the filaments in an elongated mat formation at a zone intermediate the ends of the filaments and with one end of each filament substantially in line at one longitudinal edge of the mat with the corresponding ends of the other filaments, said means being movable to convey the mat longitudinally and the filaments laterally, a roughening element having a plurality of parallel abrasive ribs equidistantly spaced along a common axis and gradually decreasing in diameter from one end to the other of said element and means mounting said element with its smaller end extending toward the leading end of said mat holding means and with said axis oblique to the plane of movement of said mat and to the filaments, means cooperative with the last-named means for moving said element selectively into and out of the path of movement of said mat to cause and to interrupt contact of the filaments with said ribs of said element, respectively, and means for rapidly rotating said element about its axis.

3. Apparatus as defined in claim 2 wherein said roughening element is conical in shape and has a plurality of circumferential abrasive ridges on its periphery spaced longitudinally thereof and is mounted to rotate about its axis, and wherein the last-named means provides for rotation of said element at speeds of the order of two thousand revolutions per minute.

4. Apparatus as defined in claim 3 wherein there is a main frame on which the first-mentioned means for holding and moving said mat is mounted, and the means mounting said roughening element includes a superframe on said main frame, support plates pivotally mounted on said superframe and carrying said roughening element for movement into and out of the path of movement of the mat, and means for swinging said plates about their pivots on the superframe, and the means for rotating said element includes an electric motor on said support plates and a driving connection between said motor and said roughening element.

5. Apparatus as defined in claim 4 wherein certain of said support plates are adjustable relatively to the other plates to adjust the roughening element on said mounting means.

6. Apparatus as defined in claim 2 wherein said first-mentioned means for holding and moving said filaments includes two spaced opposed separate chain reaches gripping said mat between them, and a wheel over which pass said chain reaches and mat, and said roughening element is disposed at one side of said wheel in juxtaposition thereto so as to be movable into contact with said filaments as they move over said wheel.

7. Apparatus for roughening smooth, resilient filaments, comprising means for holding a plurality of the filaments in an elongated flat mat formation at a zone intermediate the ends of the filaments and with one end of each filament substantially in line at one longitudinal edge of the mat with the corresponding ends of the other filaments, a roughening element comprising a body having a plurality of concentric abrasive ridges that lie in spaced parallel relation to each other in the conical surface of an imaginary cone, and means for rapidly rotating said roughening element about its axis, the first-mentioned means being movable to convey the mat longitudinally and the filaments laterally into contact with said abrasive ridges successively from the smaller end to the larger end of said conical surface with the axes of said filaments obliquely disposed with respect to the axis of said conical surface, providing for flexing of said filaments and pressing thereof under their inherent resiliency into contact with said ridges.

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8. Apparatus for roughening smooth, resilient filaments, comprising holding means for holding a plurality of the filaments in an elongated flat mat formation at a zone intermediate the ends of the filaments and with one end of each filament substantially in line at one longitudinal edge of the mat with the corresponding ends of the other filaments, driving means for said holding means to convey the mat longitudinally and the filaments laterally, a roughening element comprising a body having a plurality of concentric abrasive ridges that lie in spaced parallel relation to each other in the conical surface of an imaginary cone, means mounting said roughening element in the path of movement of the bristle ends at said longitudinal edge of the mat with its taper extending in the general direction of movement of the mat and with its axis oblique to the plane of movement of the mat and oblique to the axis of said filaments, and means for rapidly rotating said roughening element about its axis, providing for flexing of said filaments and pressing thereof under their inherent resiliency into contact with said

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ridges as the mat is conveyed past said roughening element.

9. The apparatus as defined in claim 8 wherein the axis of rotation of said roughening element is disposed at an angle of the order of 35 degrees to 55 degrees to the axes of said filaments and of the order of 15 degrees to the general plane of movement of the mat.

10. The apparatus as defined in claim 8 wherein the last-named means rotates the roughening element in the same direction as the movement of the mat of filaments at the points of contact of the ridges with the filaments.

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