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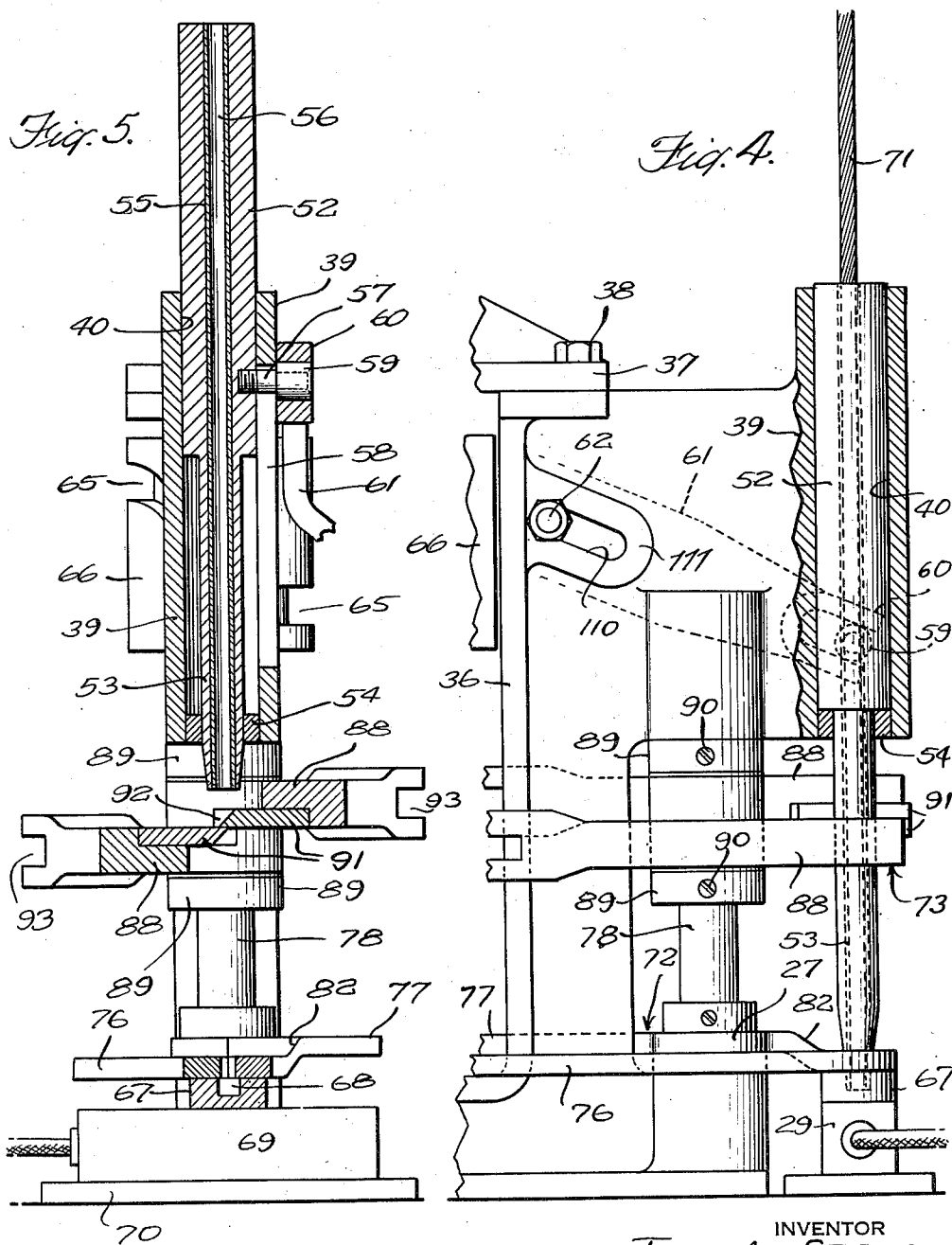
J. A. STARR

2,531,482

METHOD OF MAKING BRUSHES

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3 Sheets-Sheet 2



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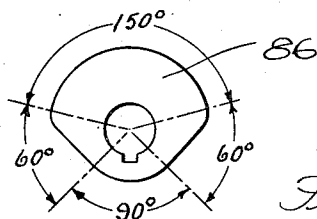
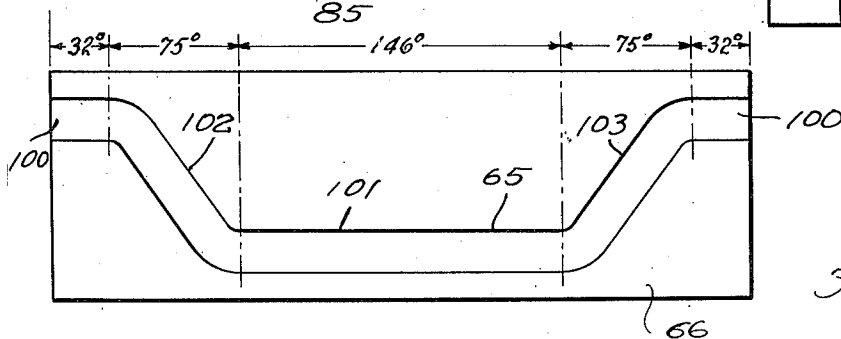
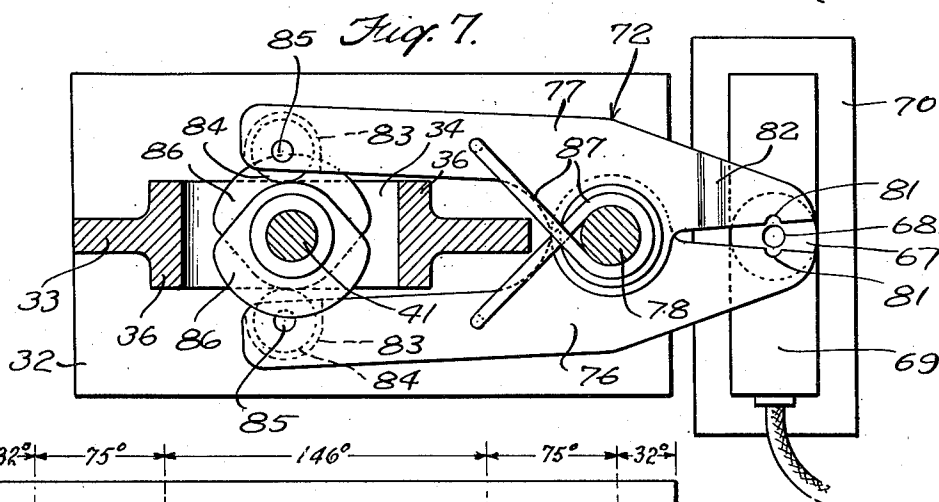
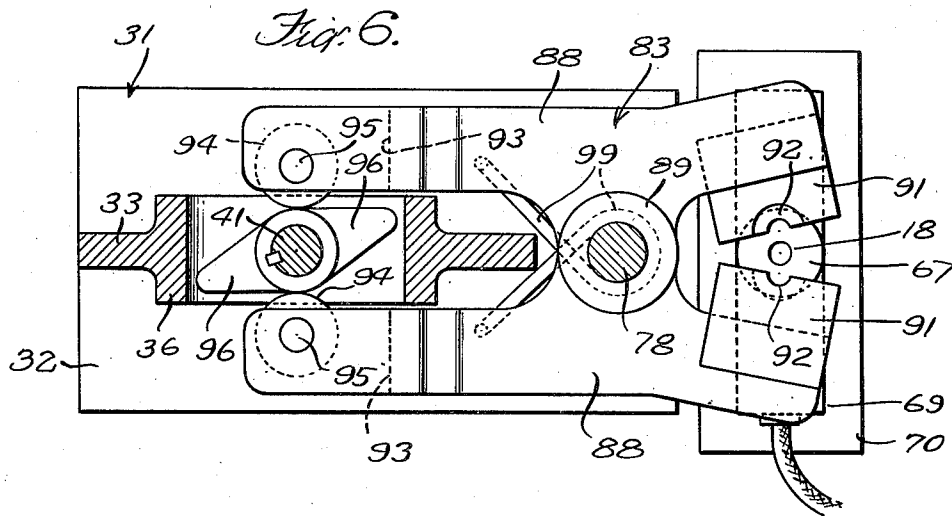
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METHOD OF MAKING BRUSHES

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Application November 30, 1946, Serial No. 713,342

4 Claims. (Cl. 300—21)

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This invention relates to a method of making tufted brushes having bristles of plastic material. The bristles may be made from any suitable plastic material which is solid and hard at temperatures under 250° F., but which will soften and liquify when sufficient heat is applied thereto, and will again harden and solidify when cooled.

According to my new improved method, long strands of the desired diameter are first made from the selected plastic material. A multiplicity of these strands are then twisted together into a rope, when making brushes according to one phase of my invention. The end of the rope is then subjected to sufficient heat to fuse the ends of the bristles together and the desired length is then cut from the end of the rope thus forming a tuft of bristles with the butt end of the bristles all fused together. This operation is repeated as successive lengths are cut from the rope. The tufts are then suitably secured in holders.

The principal object of my invention is to provide a method of making tufted brushes, having plastic bristles, which will speed up the manufacture of brushes of this type and thereby materially reduce the cost of manufacture.

Another object of my invention is to provide a method by which tufted brushes can be made that are superior to brushes made by other known methods.

Other and more limited objects of the invention will be apparent from the following specification and the accompanying drawings forming a part thereof wherein:

Fig. 1 is a fragmentary section through a brush made according to my improved method;

Fig. 2 is a perspective view of a single tuft ready to be secured in a suitable holder;

Fig. 3 is a side elevation of a machine especially adapted for automatically making bristle tufts, according to my improved method, from a rope of plastic bristle strands;

Fig. 4 is a fragmentary side elevation of the forward end of the machine of Fig. 3, showing the parts thereof in a different position;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 3;

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 3;

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 3;

Fig. 8 is a development of the drum cam which operates the rope feeding mechanism in timed relation to the rest of the machine; and

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Fig. 9 is a detail plan view of one of the clamping jaw operating cams.

In Figs. 3 to 9 inclusive I have illustrated a machine for automatically making bristle tufts from a rope of bristle strands. This machine per se forms no part of this application but is the subject matter of my co-pending application, Serial No. 713,341, filed Nov. 3, 1946.

The bristle strands of plastic material are twisted into a rope which is suitably supported in operative relation to the machine, preferably upon a reel. The end of the rope is inserted into the rope feeding mechanism which automatically successively feeds predetermined lengths thereof past a shearing mechanism and a pair of clamping jaws and successively brings the end of the rope into contact with a suitable heating mechanism. Just as the end of the rope contacts the heating mechanism the clamping jaws close and tightly grip and hold the rope near the end thereof. The jaws hold the end of the rope in contact with the heating mechanism while the rope feeding mechanism moves from the position shown in Fig. 4 back to its initial position as shown in Fig. 3. After the feeding mechanism reaches its initial position it dwells for an interval before again moving downwardly to feed the next length of rope. During this dwell of the feeding mechanism the shearing mechanism is operated, cutting off the length of rope therebelow. The clamping jaws then open releasing the rope and the cut-off piece is then removed from the machine. This can be done manually, or if desired suitable mechanism may be provided to automatically remove the cut-off ends of the rope. The heat applied to the ends of the rope of bristle strands melts it and causes the ends of the bristles to all fuse together. Then as the cut-off piece is removed from contact with the heater the melted portion quickly sets and hardens into a single solid sheet with the bristles extending upwardly therefrom.

Referring now to Figs. 3 to 9 by reference characters, the numeral 31 indicates generally a frame which supports the various mechanisms which make up the machine. The frame 31 consists of a base 32 and an upwardly extending web 33 which is secured thereto. The web 33 has an upwardly extending open ended cut-out portion 34 near the rear end thereof and an open ended forwardly extending cut-out portion 35 in the forward end thereof. A flange 36 formed integrally with the web 33 extends outwardly from each side thereof around the cut-out 34. The upper end of the cut-out 34 is closed by a cap

37 which is secured in place by bolts 38. The forward end of the web 33 above the cut-out 35 terminates in an enlarged section 39 having a vertically extending open ended cylindrical bore 40 therein.

A vertical cam shaft 41 by which all of the various mechanisms of the apparatus are operated in timed relation to each other, is rotatably supported, by bearings 42 and 43, within the cut-out 34. The cam shaft 41 has a bevel gear 44, rigidly secured thereto, which meshes with a bevel gear 45 secured to the forward end of a horizontal shaft 46 rotatably supported in a bearing 47. A spur gear 48 which is secured to the rear end of the shaft 16 meshes with a spur gear 49 secured to a shaft 50 extending out from a gear case 51. The cam shaft 41 is constantly driven at the proper speed from the shaft 50 through the gears 49 and 48, shaft 46 and bevel gears 45 and 44.

A feed slide 52, having a reduced cylindrical extension 53 which extends out through a plug 54 in the lower end of the bore 40, is slidably mounted in the bore 40. The slide 52 has an axial bore 55 in which is secured a liner 56 of suitable wear resistant material such as nickel chrome steel. A stud 57 which is carried by the slide 52 extends out through a vertically extending elongated slot 58, in one side of the enlarged section 39, and has mounted on the outer end thereof a roller 59. The roller 59 is engaged by the bifurcated end 60 of a lever 61 which is pivotally supported by a stud 62. The other end of the lever 61 has a stud 63 secured thereto which carries a roller 64 which is adapted to ride in the cam track 65 in a drum cam 66 secured to the upper end of the cam shaft 41. As the cam shaft 41 and cam 66 rotate the lever 61 will be oscillated on the pivot stud 62, making one complete oscillation for each rotation of the cam 66. The lever 61 will in turn reciprocate the feed slide 52. The cam track 65 is so shaped that the slide 52 will dwell at the upper and lower limits of its movement as will be explained in detail hereinafter in connection with the description of the operation of the shearing and the clamping mechanisms.

A metallic heating disc 67 having a cup shaped recess 68 therein is disposed in axial alignment with the feed slide 52. The disc 67 is supported and heated by a suitable electric heating unit 69 which rests on a heat insulating strip 70.

A rope 71 made up of a multiplicity of long plastic bristle strands is threaded through the liner 56 until the end of the rope extends out of the lower end of the liner a short distance. The rope 71 is frictionally engaged by the liner 56 with sufficient force to feed the rope if no appreciable resistance or drag is applied to the rope. But if the rope is held the liner 56 will slide along it as the feed mechanism moves. After the rope has been properly inserted in the feed mechanism with the end thereof extending out of the lower end of the feed mechanism a short distance the machine is started in operation. The feed mechanism then moves downwardly from the position shown in Fig. 3 to the position shown in Fig. 4, carrying the rope with it until the projecting end enters the cup shaped recess 68 with the ends of the strands in contact with the heating disc 67. Just as the feed mechanism reaches the lower limit of its movement the jaws of a clamping mechanism generally indicated by the numeral 72 are brought together and firmly clamp or grip the end of the rope between them just

above the heating disc 67. At the lower end of its movement the feed mechanism dwells while the clamping jaws are being brought together to grip the rope. As soon as the clamping jaws have gripped the rope, the feed mechanism quickly moves back to its initial position, sliding up about the rope 71 which is held from movement by the clamping mechanism 72. The feed mechanism then dwells at the upper end of its movement for an appreciable period. During this dwell a shearing mechanism generally indicated by the numeral 73 is operated to cut off the end of the rope therebelow. Both the clamping mechanism and the shearing mechanism are then opened and the cut-off end of the rope, now forming a tuft of bristles 10, is removed from the machine. During the time the end of the rope was held in contact with the heating disc 67 the ends of the bristle strands melted and fused together. As the tuft 10 is removed from the machine the melted lower end thereof quickly cools and solidifies into a thin sheet, as indicated at 11 in Fig. 2, with the bristles extending outwardly therefrom. It will thus be seen that a tuft of bristles having the butt ends of the bristles all fused together is formed during each cycle of operation of the machine.

The clamping mechanism shown in detail in Fig. 7 comprises a pair of opposed levers 76 and 77 which are pivotally mounted upon a supporting shaft 78 intermediate their ends. The shaft 78 is supported in suitable sockets 79 and 80 in the web 33 and extends across the cut-out portion 35 of the web. The forward ends of the levers 76 and 77, which constitute the clamping jaws, each has an opposed semi-circular recess 81 in the edge thereof. The radius of each of these recesses 81 is substantially the same as the radius of the rope being used and when the jaws are closed the center of these recesses is coincident with the axis of the feed slide 52. The levers 76 and 77 are mounted one above the other upon the shaft 78 as shown in Figs. 9, 10 and 11. In order to bring the forward ends of these levers into register with each other the lever 77 is bent downwardly the thickness of the lever 76 as indicated at 82. The rear end of each of the levers 76 and 77 is recessed, as indicated at 83, and has a roller 84 mounted therein upon a stud 85 extending across the recess 83. The rollers 85 are engaged by cams 86 upon the cam shaft 41. The cams 86, which are identical with each other, are disposed one above the other in opposite phase upon the cam shaft 41. The upper cam 86 operates the lever 77 and the lower cam 86 operates the lever 76. These cams which are shown in detail in Fig. 15 are so shaped that the jaws will be held closed during the first 150° rotation of the cam, will open during the next 60° rotation of the cam shaft 41, will be held open during the next 90° rotation of the cam shaft and will close during the next 60° rotation of the cam shaft. Suitable spring means 87 is provided to open the clamping jaws.

The shearing mechanism 73 comprises a pair of identical opposed levers 88 which are mounted one above the other upon the shaft 78 between collars 89 which are held in position upon the shaft 78 by set screws 90. Each lever 88 has a shear blade 91, having a semi-circular cutting edge 92, secured to the forward end thereof. The rear end of each of the levers 88 is bifurcated, as indicated at 93, and has a roller 94 mounted therein upon a stud 95. The rollers 95 are adapted to be engaged by cams 96 disposed one above

the other in opposite phase upon the cam shaft 41 between collars 97 which are held in position upon the cam shaft 41 by set screws 98. The cams 96 are so shaped that they will operate the levers 88 to move the cutting edges 92 of the shear blades 91 to cut the rope during 73° rotation of the cam shaft 41, will let the shear blades move back to open position under the influence of suitable spring means 99 during the next 73° rotation of the cam shaft 11, and will allow the levers and shear blades to dwell in the position shown in Fig. 12 during the next 214° rotation of the cam shaft 11. It is during this 214° dwell that the feed slide 52 moves from the position shown in Fig. 3 down to the position shown in Fig. 4 and back to the position shown in Fig. 3.

A development of the drum cam 66 which operates the feed slide 52 through the lever 61 is shown in Fig. 14. From this view it will be seen that the cam track 65 comprises upper and lower straight sections 100 and 101 respectively which are connected by inclined sections 102 and 103. The lower section 101 extends 146° around the cam 66 and the upper section 100 extends 64° around the cam 66 diametrically opposite the section 101. The sections 102 and 103 each extend 75° around the cam 66. From Figs. 3 and 8 it will be seen that the section 101 will cause the feed slide 52 to dwell at the upper limit of its movement during 146° rotation of the cam shaft 41; and that the section 100 will cause the feed slide to dwell at the lower limit of its movement during 64° rotation of the cam shaft 41. It will also be apparent that the slide 52 is moved downwardly, after dwelling at the upper limit of its movement, during 75° rotation of the cam shaft 11; and that after dwelling at the lower limit of its movement it is moved upwardly during the next 75° rotation of the cam shaft 41.

In order to adjust the apparatus for making tufts of different lengths, provision is made for varying the stroke of the feed plunger 52 and the position of the shearing mechanism 73. The lower limit of the slide movement must be the same for all length tufts as no provision is made for varying the position of the heating element 69 and heating disc 67 with which the end of the rope 81 is brought into contact each stroke of the feed slide. The adjustment is made by changing the upper limit of the slide movement, and this is accomplished by changing the position of pivot stud 62 both with respect to the frame 31 and the lever 61. Changing the position of the stud 62 with respect to the lever 61 increases or decreases the stroke of the slide 52, and by changing its position with respect to the frame the lower limit of the slide movement is maintained the same regardless of the length of the stroke.

In order to make this adjustment to enable the apparatus to form tufts of different lengths the pivot stud 62 is adjustably mounted in an elongated slot 110 through a thickened portion 111 of the web 33. This slot slopes downwardly to the right as shown in Figs. 3 and 4. The lever 61 has an elongated slot 112 therethrough in which is slidably mounted a block 113 having a bore for the reception of the stud 62. The stud 32 also extends through a spacing collar which maintains the lever 61 in proper position with respect to the cam 66 and feed slide 52. The block 113 is adjusted and maintained in position in the slot 112 by a screw 116 which is mounted in a threaded aperture in a boss 118, adjacent one end of the slot 82, and has one end thereof rotatably mounted in a T-slot 119 in the block 113. The boss 118

is slotted and a bolt 121 is provided for clamping the screw 116 in adjusted positions.

The position of the shearing mechanism is adjusted by loosening the set screws 90 and raising or lowering the levers 88 upon the pivot shaft 78 in accordance with the adjustment of the stroke of the feed slide 52. The position of the cams 96 upon the cam shaft 41 must also be changed in accordance with any change in position of the levers 88. This is accomplished by loosening the set screws 98 and moving the cams up or down on the shaft 41 as desired. In the drawing the apparatus is shown as adjusted for making the maximum length tufts within the capacity of the machine.

From the foregoing it will be apparent to those skilled in this art that I have provided a very simple and effective method for accomplishing the objects of my invention.

I claim:

1. In the manufacture of brushes, the method of forming individual tufts consisting in periodically advancing a multiplicity of endless filaments which are combined into a rope and thereby bringing the end of the rope into contact with a heating element, clamping the end portion of the rope with said end in contact with the heating element and holding it clamped for a sufficient period to fuse the ends of the filaments, severing the rope at a point adjacent the clamp, and then releasing the clamp.

2. In the manufacture of brushes, the method of forming individual tufts consisting in periodically advancing a multiplicity of endless filaments which are combined into a rope and thereby bringing the end of the rope into contact with a heating element, holding the said end against said heating element for a sufficient time to fuse the ends of the filaments together, severing a length of the rope including said end, and removing said severed length from the heating element.

3. In the manufacture of brushes, the method of forming individual tufts consisting in simultaneously advancing the ends of a multiplicity of endless filaments into contact with a heating element, clamping said filaments tightly together adjacent said heating element with said ends in contact with said heating element and holding said filaments clamped for a sufficient period to fuse said ends together, severing said filaments a predetermined distance from the fused ends thereof, and then releasing the clamp.

4. In the manufacture of brushes, the method of forming individual tufts consisting in successively cutting predetermined lengths from the end of a rope of endless filaments, successively advancing the end of said rope from which said predetermined lengths have been cut into contact with a heating element, clamping the filaments tightly together and holding them clamped until the ends thereof fuse together, and then releasing the clamp.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
764,898	Mumford	July 12, 1904
1,563,367	Hultqvist	Dec. 1, 1925
2,303,800	Swann	Dec. 1, 1942
2,341,823	Smith	Feb. 15, 1944
2,438,156	Dodge	Mar. 23, 1949