April 27, 1943. W. PENN-GASKILL HALL ET AL 2,317,401

CONTINUOUS FILAMENT BRISTLE FEEDING MECHANISM

Filed Dec. 13, 1940 4 Sheets-Sheet 1

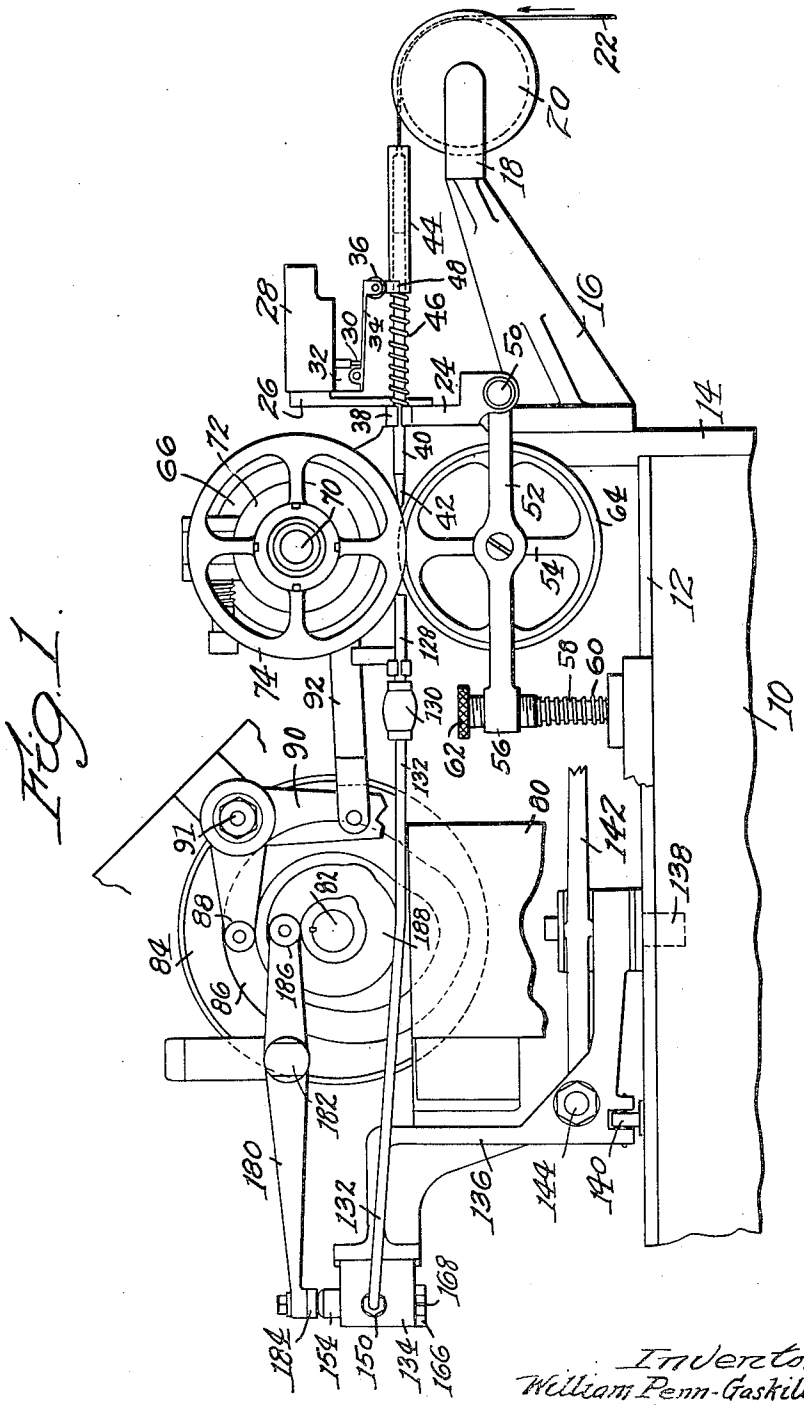


Fig. 1.

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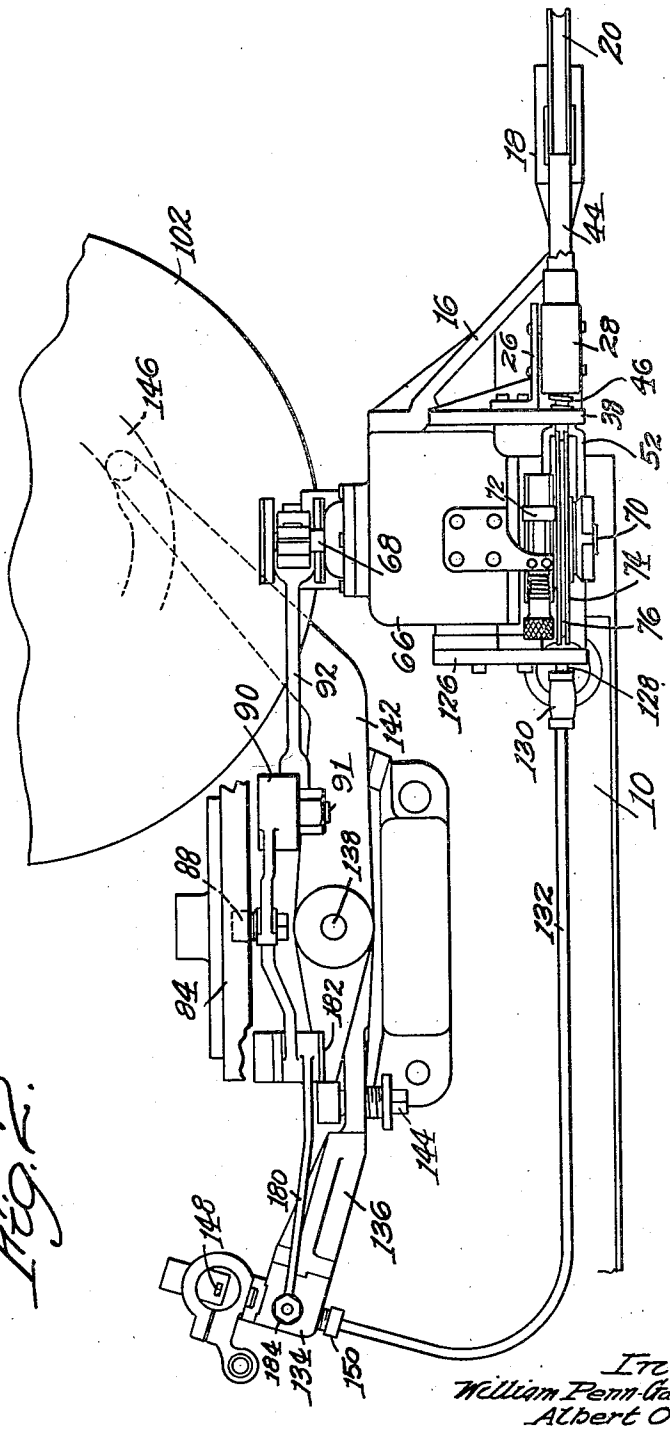


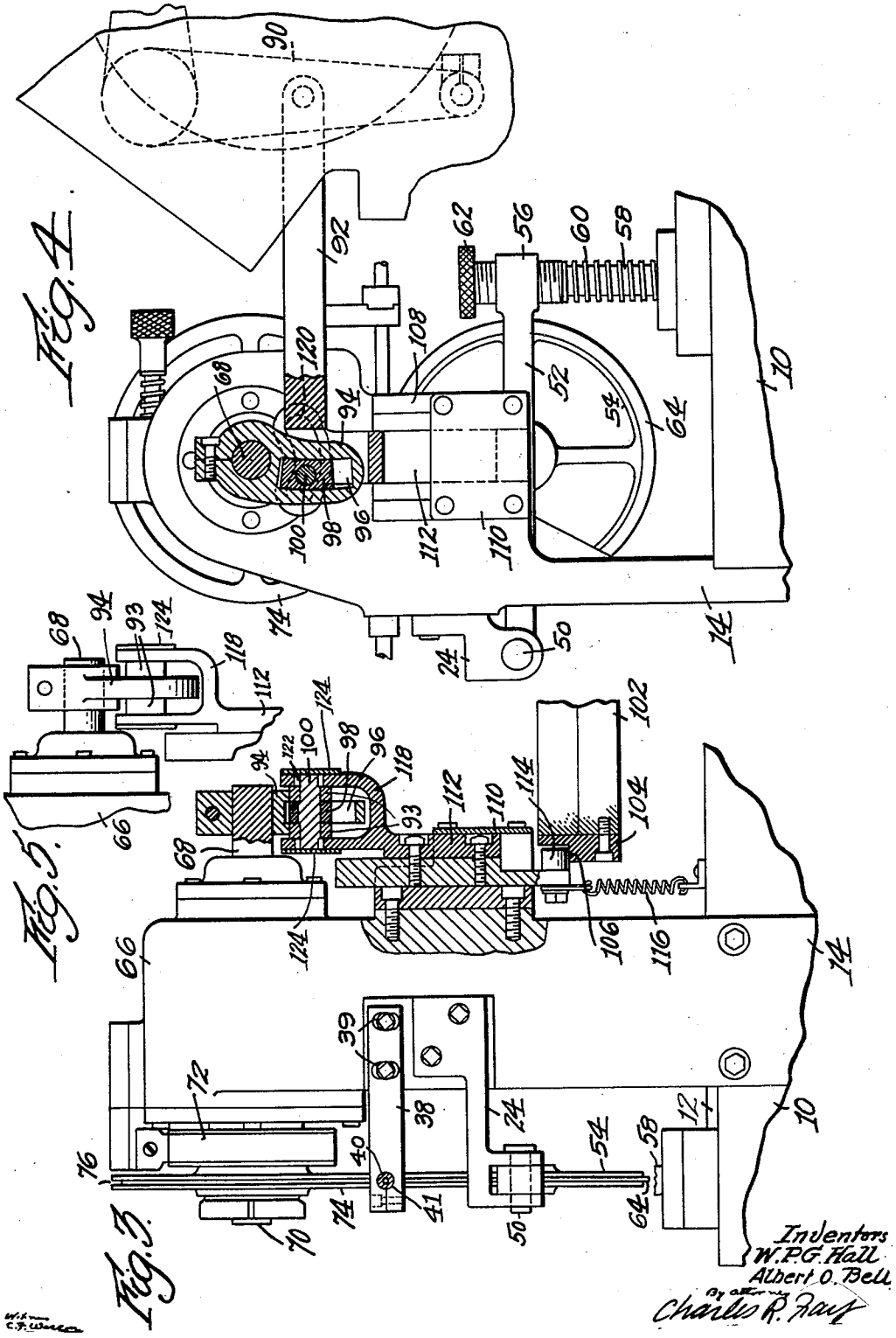
Fig. 2.

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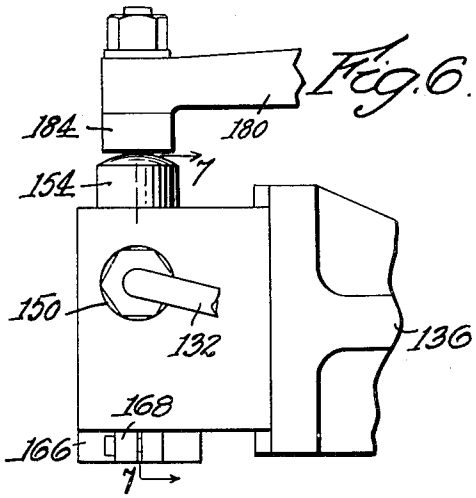


Fig. 6.

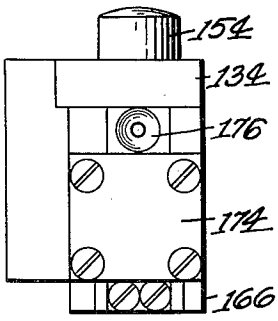


Fig. 9.

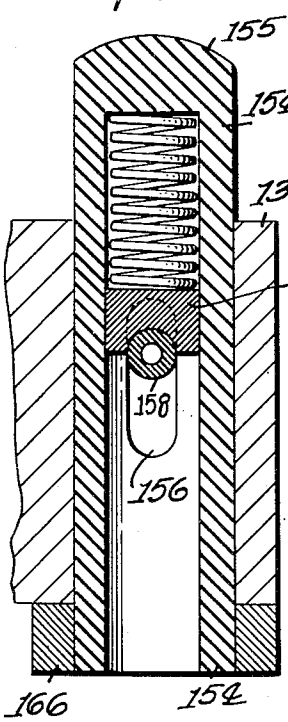


Fig. 8.

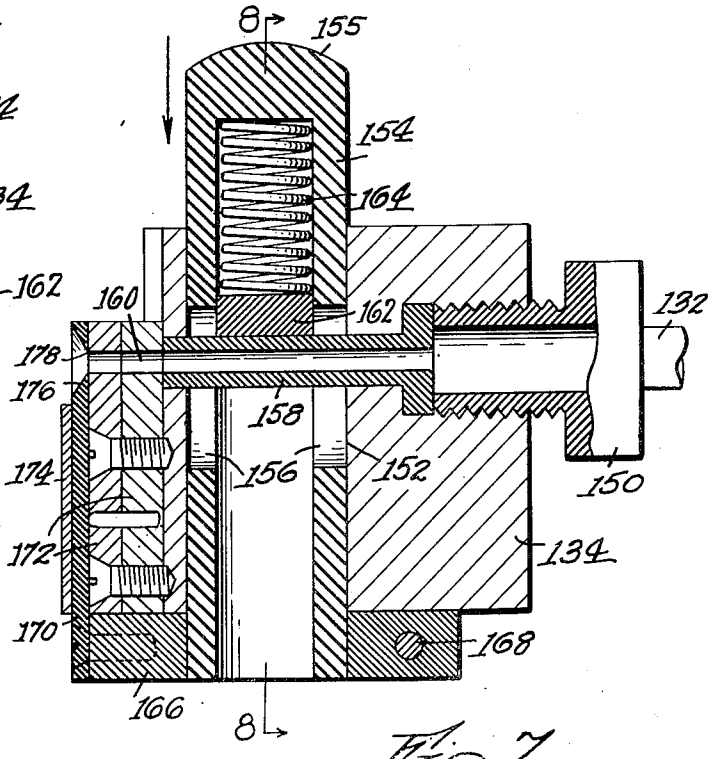


Fig. 7.

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UNITED STATES PATENT OFFICE

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CONTINUOUS FILAMENT BRISTLE FEEDING MECHANISM

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Application December 13, 1940, Serial No. 370,030

20 Claims. (Cl. 300—8)

This invention relates in general to mechanisms for the feeding and cutting of continuous filaments, and more particularly to mechanisms for the intermittent variable feeding and cutting of continuous synthetic filaments to produce tufts of correct but varying lengths and of uniform numbers of bristles for setting in brush blanks in the manufacture of brushes having predetermined bristle forms or contours.

Objects of the invention include the provision of means and methods for producing bristle tufts having a uniform and predetermined number of bristles; the provision of means for intermittently feeding a continuous filament or filaments to a bristle shearing device whereby bristles of desired uniformity and predetermined lengths are automatically produced; the provision of means for feeding a continuous filament or filaments in increments to a bristle setting mechanism, and providing a shear cutter to cut the filament to bristle lengths at the setting station, so that the bristles are set in brush blanks immediately upon their formation from the continuous filament; the provision of means as just above described in which the feeding means is variably actuated according to a predetermined pattern, and in which the shear is movable in accordance with the feed to insure that the center of each bristle sheared from the filament will be centrally located at the setting die for correct operation of the setting needle in doubling and setting each knot or tuft regardless of its length; and the provision of means and methods for producing bristles and brushes having bristles or tufts of varying lengths thru the utilization of a continuous filament which is fed, cut, formed into a tuft or knot, and set, completely automatically.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which:

Fig. 1 is a view in front elevation of the mechanism embodying the present invention;

Fig. 2 is a top plan view of the mechanism of Fig. 1;

Fig. 3 is a view in side elevation on an enlarged scale of the filament feeding means and its control, parts being in section;

Fig. 4 is a rear elevation of the mechanism of Fig. 3;

Fig. 5 is a detail elevational view of the feed control;

Fig. 6 is an elevational front view of the shear housing;

Fig. 7 is an enlarged section on line 7—7 of Fig. 6;

Fig. 8 is a section on line 8—8 of Fig. 7; and

Fig. 9 is an elevational rear view of the shear housing.

Brushes of many descriptions, and especially toothbrushes, are often made so that their bristles as a whole present irregular conformations at their free ends, and this has been accomplished by merely grinding or cutting the uniform length bristles by means of a shaper cutter or wheel to the shape desired after the bristles or knots have been set in the brush blanks. This has been necessary because of the fact that the knots are set into the brush blanks by a needle which forces a tuft of equal length pre-cut bristles thru a die into a drilled blank, the bristles having been stored in a hopper until removed therefrom in tufts by a bristle picker for advancement to the setting station. The present invention avoids the shaping operation, and obviates the necessity for the hopper and picker mechanisms, by the use of a completely different method and apparatus which is based on the conception of the fact that brush bristles may be made from continuous filaments of synthetic material.

Referring to Figs. 1 and 2 in the drawings, the bristling machine base is shown at 10, and this base is ordinarily provided with a top 12 upon which the mechanism of the present invention may be mounted. A bracket 14 is bolted to the back of the machine base 10, and this bracket rises above the top 12 for the support of various devices as will be hereinafter described. An angled bracket 16 is secured to and extends rearwardly from bracket 14, terminating in a yoke 18 for the support of a free roller 20, which is grooved as shown for the guiding support of the incoming continuous filament 22. This filament may be stored on a reel, and is made up of a predetermined number of separate continuous elements assembled together. The separate elements may be of varied thicknesses and colors as desired.

A further bracket 24 is secured to bracket 14. Bracket 24 may provide a support for a member 26 to which is secured a "micro-switch" 28 having a downwardly extending operating plunger 30. The member 26 is provided with a depending finger 32 for the pivotal support of a lever 34, the latter having a roller 36 at its free end. An arm 38 is adjustably secured to bracket 14 by means of bolt and slot connections 39, and this arm is provided with a split forward end having a circular depression 41 for the clamping securement

of a tube 40, as shown in Fig. 3. This tube is rigidly held and terminates forwardly in a nozzle 42, while at its rearward end it slidingly receives a larger diameter tube 44. A compression spring 46 is adapted to bear against the bar 38 at one end and against the forward end of tube 44 at its other end, so as to normally urge the latter to its rearward most extent as limited by any convenient stop means (not shown) on tube 40. An upwardly extending abutment 48 is provided at the forward end of tube 44 to normally position lever 34 in raised position to engage and hold plunger 30 in closed position of the switch 28. It will be clear that filament 22 runs thru tubes 44 and 40, which guide it, and that if a knot or other defect should exist on the filament, it will engage the rearward end of tube 44 and thrust it to the left in Fig. 1, against the action of spring 46. The roller 36 would then be disengaged from the abutment 48 and as the lever 34 would then move in a clockwise direction, the switch will open. This switch may be connected in circuit with the motors for driving the mechanism, and hence an imperfect spot on the filament may cause stoppage of the machine.

Bracket 24 depends to form a journal for a pin 50 which pivotally mounts a slotted arm 52. Substantially centrally of this arm and in the slot, there is freely journaled a wheel 54, and at the forward end of the arm there is a vertical internally screw threaded boss 56. A resilient support for the arm and wheel is provided and this support consists of a vertical stationary pin 58 surrounded by a coil spring 60 which extends from the base of the pin to the lower end of a vertically arranged hollow screw 62. The pin 58 and screw 62 are arranged for relative axial sliding movement by means of the pin entering the hollow portion of the screw. The spring urges the screw away from the machine top 12 and the screw engages and meshes with the boss 56 in the arm 52. By turning the screw, it will be seen that the resilient upward pressure on wheel 54 can be regulated. An outstanding peripheral rib 64 is provided on wheel 54 for a purpose to be described.

Bracket 14 rises to support a housing 66 which contains an over-running clutch preferably of the roller and cam type. This clutch is operated from a shaft 68 (Figs. 3 to 5), which upon being rotated in one direction will cause the cams to force the rollers into frictional engagement with the driven element 70 of the clutch to correspondingly rotate the same. Upon the reverse rotation of the shaft, the rollers will back off, but the driven element will not return to initial position due to a brake 72 which is frictionally engaged with the driven element. The type of clutch just described is well known in the arts and industries and it is thought that it need not be disclosed in detail here.

A wheel 74 similar in diameter to wheel 54 is secured to the driven element 70 of the clutch by a nut or other fastening, and this wheel is arranged above wheel 54 and in parallel alignment therewith. A peripheral groove 76 on wheel 74 fits rib 64, so that a guideway for the filament is provided between the wheels. As wheel 74 is driven, the filament will be fed by reason of the resilient action of wheel 54 pressing or backing up the filament against the bottom of groove 76, and the length of each feed of the filament depends directly upon the angle of turn or rotation of shaft 68. Hence, if shaft 68 be turned intermittently thru varying angles and between each turn reversing or backing off, the filament will be seen to be fed in steps of varying lengths, and in one direction only; i. e., towards the front of the machine, in the direction of the arrow in Fig. 1.

The mechanism for imparting variable degrees of turning movement to shaft 68 will now be described. From the machine top 12, there rises a bracket 80 of any convenient form, and a shaft 82 is journaled therein. This shaft is motor driven and has keyed thereto a generally circular cam plate 84. In one face, this plate is provided with a cam track 86 in which runs a follower 88 on the end of one arm of a bell-crank lever 90 which is stationarily pivoted at 91 to a fixed part of the machine. The other arm of the bell-crank has pivoted thereto one end of an arm 92 which extends rearwardly of the machine to the vicinity of shaft 68 of the clutch. At this point, the arm is formed into a yoke having apertured legs 93.

Referring to Figs. 3 to 5, it will be seen that shaft 68 has rigidly clamped thereto a lug having a central reduced depending portion 94, this portion being provided with a curved slot 96, and legs 93 of arm 92 embrace the depending portion 94. A slide block 98 is located in slot 96, this block having its edges curved to conform to the slot so that it may be traveled therein. A pin 100 extends thru the slide block and each leg 93, so that as arm 92 is reciprocated it will necessarily oscillate the lug portion 94, thus oscillating shaft 68 correspondingly. As recited above, rotation of the shaft in one direction rotates wheel 74 while rotation in the other direction has no effect on the wheel. Hence each reciprocation of arm 92 will feed the filament one step. It will be clear that if pin 100 remains at a constant distance from the center of shaft 68, each step of feed of the filament will be equal, but that if the pin 100 (and slide block) is moved outwardly of shaft 68, as downwards in slot 96, Fig. 4, the movement of arm 92, which is always the same in distance, will cause the lug and hence the shaft to move thru a smaller angle, and thus provide a shorter step of feed of the filament. Sufficient range of variable steps is provided by the length of slot 96, in which the slide block and its pin may be moved to vary the stroke of the lug, hence varying the angular travel of shaft 68 and thereby varying the length of the filament feed.

In Fig. 2, a large horizontal wheel cam 102 is shown, this cam being rotatably mounted and motor driven. In Fig. 3, it will be seen that the cam is divided into upper and lower elements which are secured together. The upper element may be used to operate other elements of the machine not here at issue and hence not shown, and the lower cam has a peripheral collar 104 secured thereto and milled to provide a surface at 106 which is variable in height according to the predetermined lengths of the feed steps for the filament. Vertical members 108 forming a guideway are secured to the rear of bracket 14 and a plate 110 closes the guideway to slidingly accommodate a vertical post 112 having a cam follower 114 at its lower end. A tension spring 116 connected to post 112 and to the machine base 10 insures that the follower will always rest on the surface 106 so that the post 112 will be vertically reciprocated according to the cam. At its upper end, post 112 is formed in the shape of an elongated yoke 118 having curved slots 120, see Fig. 4. The pin 100 extends into these slots at each of its ends and small rollers 122 are ap-

plied to the pins in the slots. Plates 124 are screwed to the legs of yoke 118 to close the outer sides of slots 120.

It will be seen from the above that as cam 102 turns, post 112 is vertically reciprocated, and carries with it pin 100 and hence the end of arm 92. As cam 84 turns, arm 92 is reciprocated, and depending for the distance on the position of post 112, the lug 94 and shaft 68 will be oscillated to varying degrees, thus turning wheel 74 to feed the filament the desired lengths in intermittent steps.

Returning now to Figs. 1 and 2, it will be seen that an arm 126 is secured to the clutch housing 66, and this arm is partially divided similarly to arm 38 to support a short tube 128 which receives the filament as it is fed by the wheel 74. A flexible rubber joint 130 is attached to tube 128 and a further tube 132 extends from the joint forwardly to a housing 134. The rubber joint allows tube 132 to move without bending, and of course the filament travels thru this tube into the housing 134.

Housing 134 is vertically adjustably mounted on an arm 136 which is pivoted in the machine top at 138 and runs on a bearing roller 140. A lever 142 is also mounted to pivot about the point 138 and this lever is secured at one end to arm 136 at 144. The other end of the lever runs in a cam track 146 in the lower element of cam 102, and therefore as the latter rotates, the housing 134 is oscillated about pivot 138 to and from the die 148, which is secured to a stationary part of the machine. A vertically operating setting and doubler needle cooperates with die 148 to double the bristle into a knot, and to set the same in the blank as is well understood in the art.

Housing 134 is provided with a hollow nut 150 screwed thereinto, and tube 132 enters this nut and may be secured therein by a set-screw or the like. Transversely to the nut 150 there is an enlarged bore 152 which slidingly accommodates a hollow plunger 154 having a closed striking head 155. This plunger is slotted at opposite sides as at 156 and a guide tube 158 extends thru the slots and across the bore, connecting the inner end of the nut and a guide outlet for the filament at 160. The tube 158 is stationary in the housing and supports a block 162 which acts as a reaction point for a spring 164. The plunger extends out from the housing at its closed end, in normal or up position, as is shown in Figs. 7 and 8, due to the action of spring 164. The lower end of the plunger is prevented from entering the bore by a plate 166 firmly secured thereto by a slit and bolt clamp 168. A shear plate 170 is secured to the plate 166 and rises in parallel spaced relation to the plunger in a guide formed by blocks 172 and cover plate 174, the latter being secured to the housing by screws as shown in Fig. 9. The shear plate is provided adjacent its top with a round sunk hole 176 which is formed with a sharp inner edge 178 which cooperates with the outer edge of guide outlet 160 to shear the filament when the plunger is depressed against the action of spring 164.

A lever 180 is pivoted at 182 to a fixed point on the machine, and one end of this lever is provided with a striking hammer 184 located above the top of plunger 154. The other end of lever 180 has a cam follower 186 which rides in a cam track 188 on cam 84. It will be seen that for each reciprocation of arm 92 and consequent filament feed, the plunger 154 will be struck by the hammer 184 to sever a length of bristle from the filament. The setting needle is adapted to reciprocate once for each severance to double the bristle in the die 148, but as the needle mechanism is well known in the art, it need not be here disclosed.

The cam track 146 is so designed as to travel housing 134 to and from the die 148 in accordance with the length of bristle severed to always insure that the bristle will be centrally located over the die for correct doubling operation. Hence if a long bristle is severed, the arm 136 will move the housing slightly away from the die, and if the next bristle is short, the housing will be moved closer to the die. The movement of the housing is always proportional to the change in length between bristles, and is so small as to insure that the hammer 184 will operate the shear even though the former does not move horizontally.

The various cams are designed to operate the mechanisms in correct timed relation so that the feeding of the filament by the wheel 74 will coincide with the length of bristle next wanted in the brush.

From the above description, it will be seen that a method and machine for the production of variable length bristles has been provided, and that the lengths of the bristles may be predetermined and set in brush blanks to provide brushes having irregular bristle contours. The filament is fed in steps of varying lengths, and is severed at the die in accordance with the feed, in position to be doubled and set. The necessity for grinding or cutting the bristles to desired form is avoided and at the same time a saving of approximately 11 percent of the bristle is achieved over the old method. Bristle hoppers and pickers are avoided, and a continuous operation machine is provided in which it is only necessary to place the brush holders in position and to remove them when bristled to produce complete brushes having desired bristle contour.

Having thus described our invention and the advantages thereof, we do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what we claim is:

1. In a device of the class described, means adapted to feed a filament in steps, means effective to vary the lengths of the separate steps, means effective to predetermine the variations in length of the steps, and means to sever short lengths from said filament in proportion to the lengths of said steps.

2. In a bristling machine, the combination of a setting mechanism with means to feed a substantially continuous filament to said setting mechanism, and means to sever bristle elements of variable predetermined lengths from said filament at said setting mechanism in position to be set in a single brush blank by said mechanism without interruption to the operation of the machine.

3. In an apparatus of the class described, means adapted to feed a substantially continuous filament in steps of variable lengths with respect to a fixed point, means to sever short lengths from said filament, and power-operated means to move said severing means in the direction of filament feed in accordance with the length of filament to be severed.

4. In an apparatus of the class described, a filament feeding element, a shaft operatively connected to said element to drive the same, means

to oscillate said shaft, and means to vary the position of said oscillating means radially relative to said shaft.

5. In an apparatus of the class described, a feeding element, a shaft operatively arranged to drive said element, an eccentric on said shaft, means engaged with said eccentric to oscillate it and said shaft, and means to vary the point of engagement of said oscillating means and said eccentric to thereby vary the degree of oscillation thereof.

6. In an apparatus of the class described, a feeding element, a shaft operatively arranged to drive said element, an eccentric on said shaft, an arm, a sliding connection between said arm and eccentric, means to reciprocate said arm and thereby oscillate said shaft, and means to move said sliding connection.

7. A device of the class described comprising a housing, a guideway in said housing, a plunger, said guideway passing thru said plunger, a shear plate secured to said plunger, and effective to sever a filament in said guideway upon movement of said plunger.

8. In an apparatus of the class described, the combination of means adapted to feed a filament and means to actuate said feed means variably to feed said filament in steps of varying amounts; with means to sever an element from said filament between each step, and means to variably move said severing means in the line of the filament feed in proportion to the amount of each separate filament feed step.

9. In an apparatus of the class described, the combination of means adapted to feed a filament in variable steps; with a cutter, a filament guide extending from adjacent said feed means to said cutter, a movable support for the latter, and means to move said support and thereby said cutter in proportion to each step of said filament feed.

10. In a bristling machine, the combination of means adapted to feed a filament in steps of varying lengths to said die; with means to sever bristles from said filament, and means to vary the position of said severing means with respect to the length of said filament whereby said bristles will be severed in lengths corresponding to the individual steps of feed of said filament.

11. In a bristling machine, the combination of a die and means adapted to feed a filament in steps of varying lengths to said die; with means to sever bristles from said filament at said die, and means to vary the position of said severing means along the filament in accordance with the length of each step of filament feed to position each bristle as cut in predetermined location with respect to said die.

12. In an apparatus of the class described, the combination of bristle tuft setting means; with a guide, means remote from said guide and adapted to feed a substantially continuous filament toward said setting means through said guide, the latter holding the filament end free and unencumbered, and means effective to cut short lengths from said filament at the forward end of said guide so to free said cut lengths from said guide.

13. In an apparatus of the class described, the combination of means adapted to set a bristle tuft in a brush blank; with a guide, means remote from said guide and effective to feed a substantially continuous filament toward said setting means through said guide, means to cut relatively short bristles from said filament at the end of the guide in position to be acted upon by said setting means, and a doubler die forming a part of the setting means and acting as a temporary support for the short bristles.

14. A feeding device for a filament comprising a pair of wheels, interengaging means on said wheels to guide said filament in its feeding movement, said means including a peripheral groove in one wheel and a cooperating rib on the other wheel fitting said groove.

15. In an apparatus of the class described, means adapted to feed a continuous filament in steps, a cutter to sever variable pre-determined lengths from said filament, and power-operated means controlling the position of said cutter to sever said variable lengths with their centers all located at a fixed point.

16. In an apparatus of the class described, a filament feeding mechanism comprising a rotary wheel or the like, means adapted to intermittently rotate said wheel in steps, and means effective to control said first named means to vary the lengths of said steps.

17. A device as recited in claim 16 wherein said first named means comprises an oscillatory element, and said second named means is effective to adjust said element radially of said wheel during the oscillations of said element, there being a driving connection between said wheel and element.

18. In a bristling machine, means adapted to feed a continuous filament, a doubler die to which the filament is fed, a cutter for severing short lengths from said filament at said die, said cutter being movable along the line of filament feed, a shaft, and means operated by said shaft to move said cutter along said filament feed line.

19. A method of producing bristle tufts including the steps of providing means to advance a continuous filament in steps, controlling the length of the steps by said means, guiding the filament to a die, severing lengths from said filament, and doubling the severed lengths in the die.

20. A method of producing bristle tufts including the steps of feeding a substantially continuous filament through a guide so that the free end of the filament projects beyond the end of the guide, leaving said projecting end free, the feeding step of the filament determining the amount of projection of the end thereof, severing the projecting end of the filament, and doubling the same.

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