Nov. 28, 1950 J. A. STARR 2,531,481

BRISTLE TUFTING MACHINE

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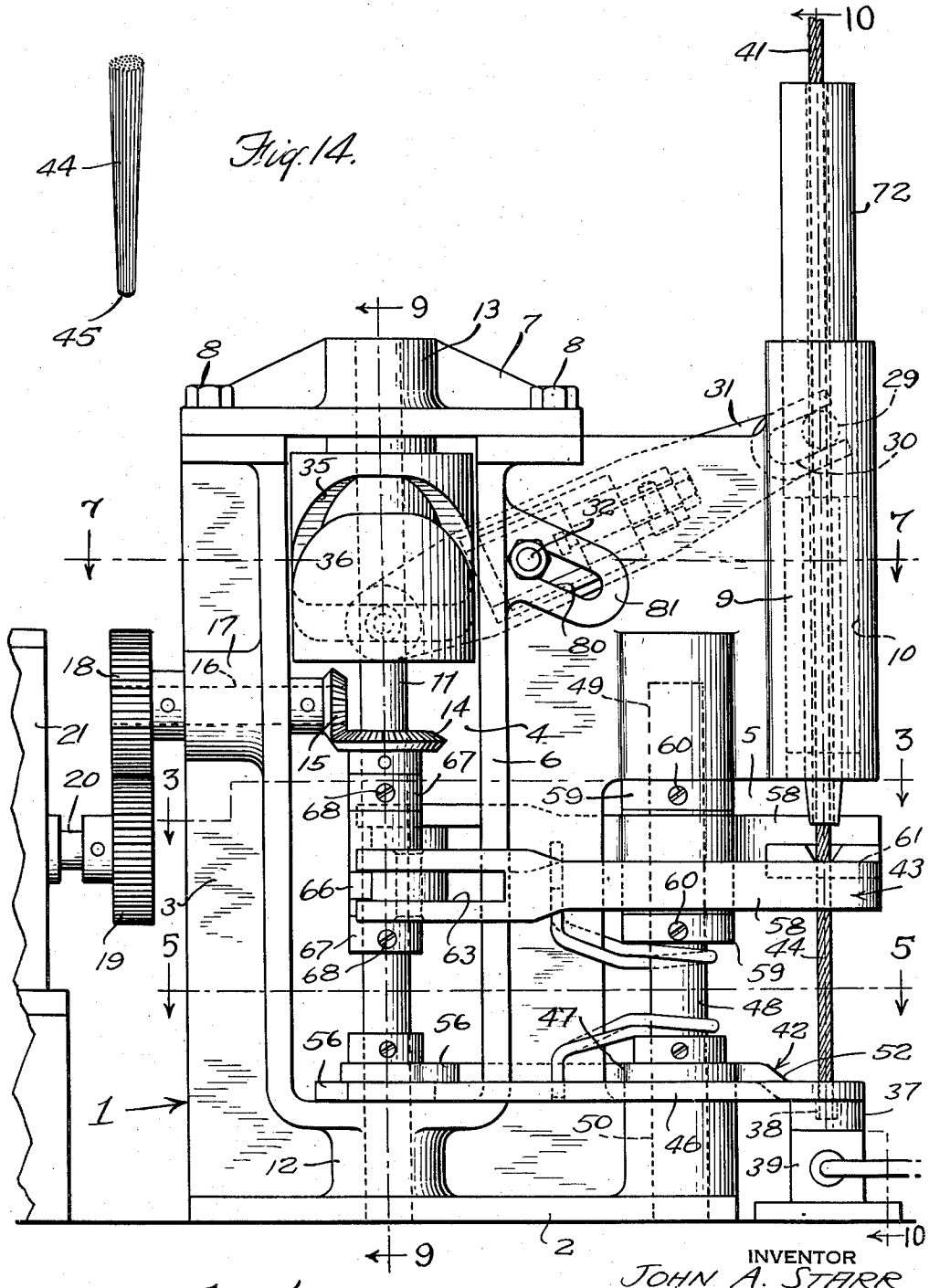


Fig. 14.

Fig. 1.

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Fig. 2.

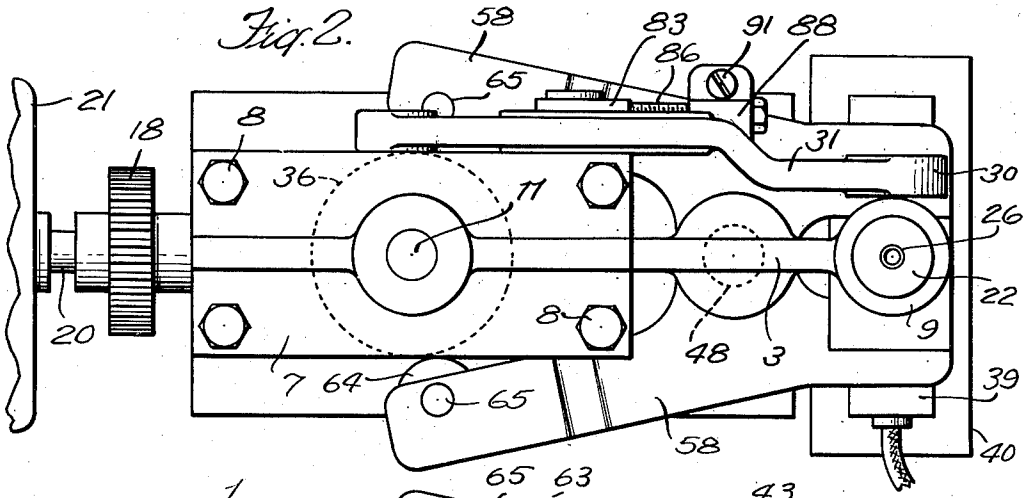
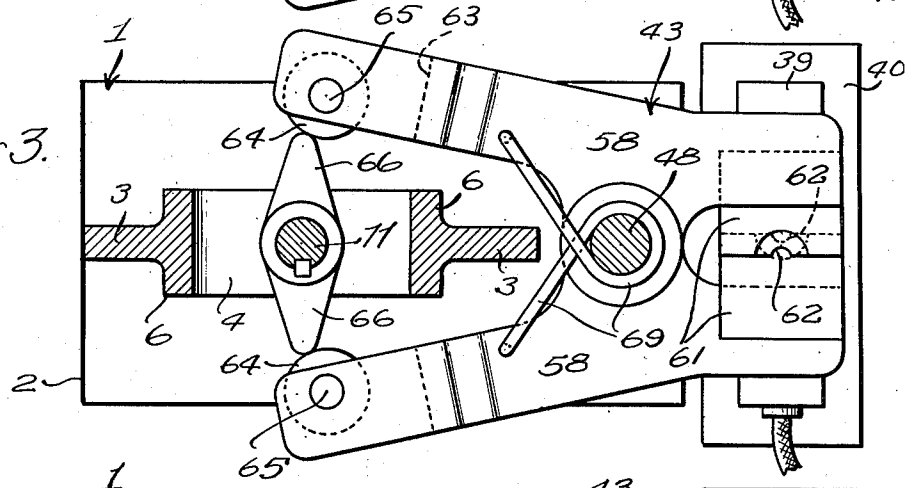


Fig. 3.



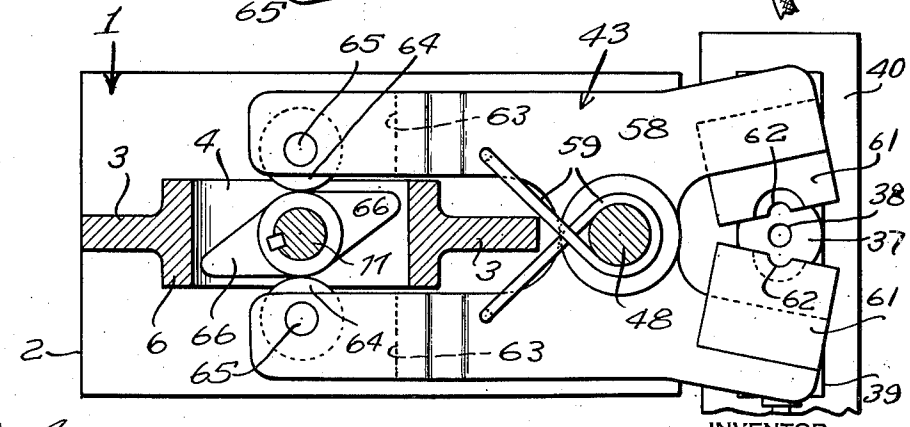


Fig. 4

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Fig. 5.

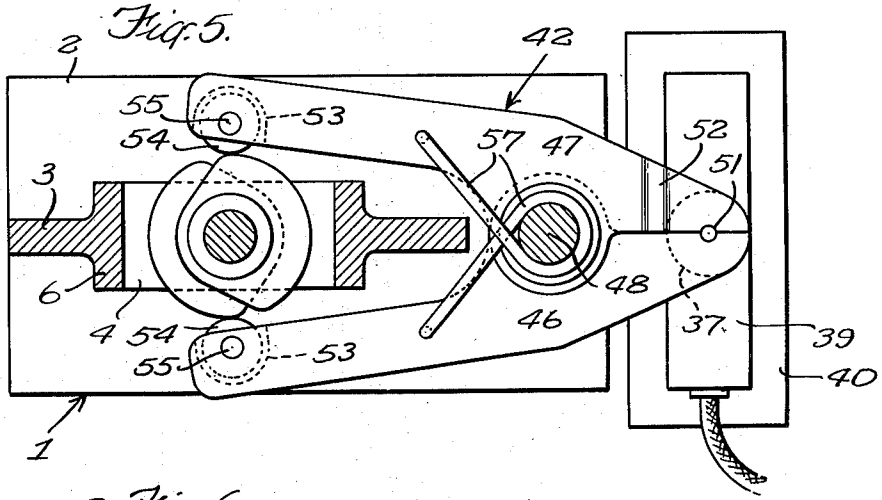
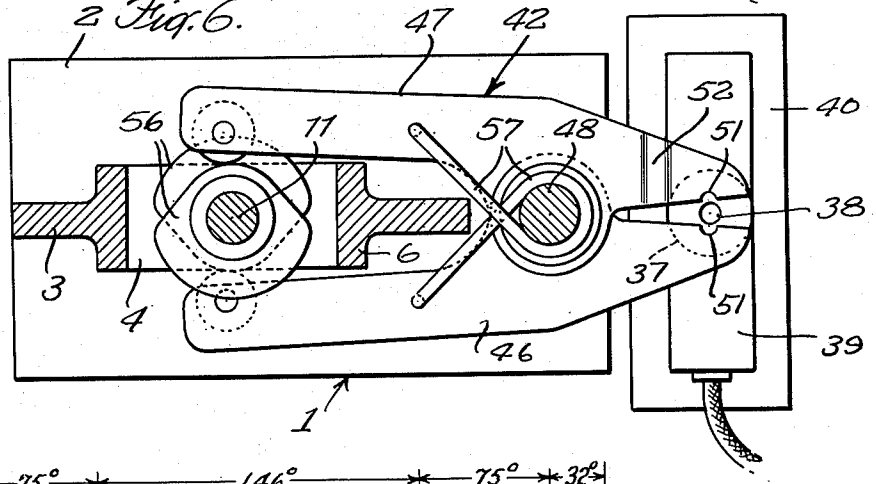


Fig. 6.



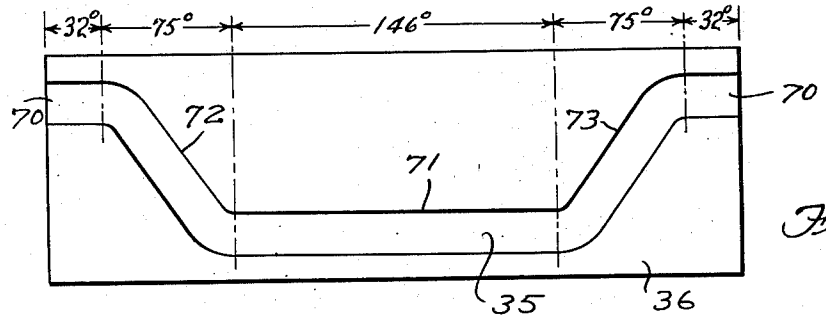


Fig. 12.

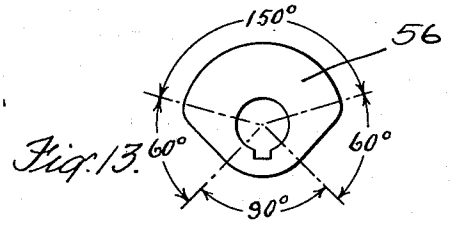


Fig. 13.

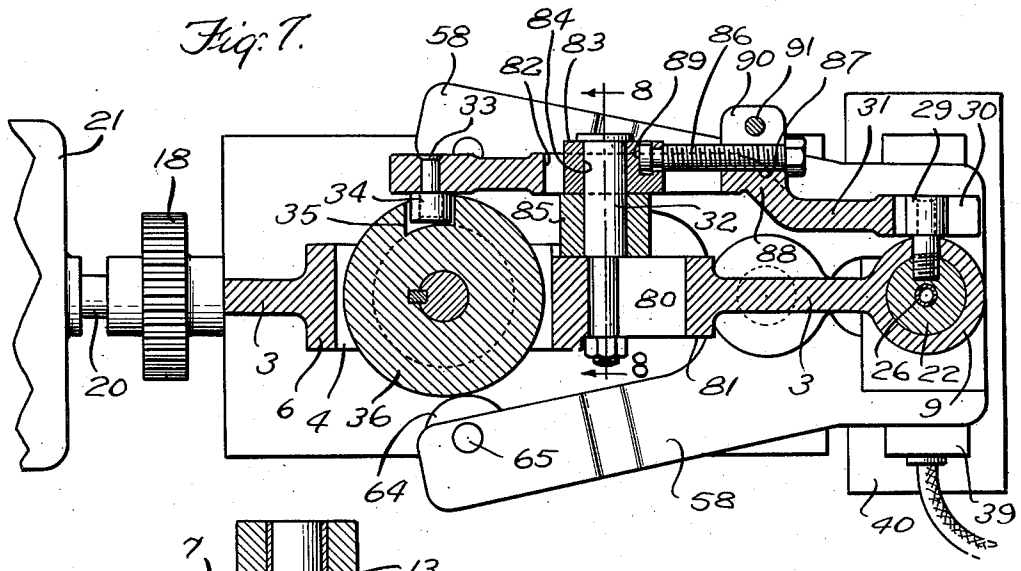
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Fig. 7.



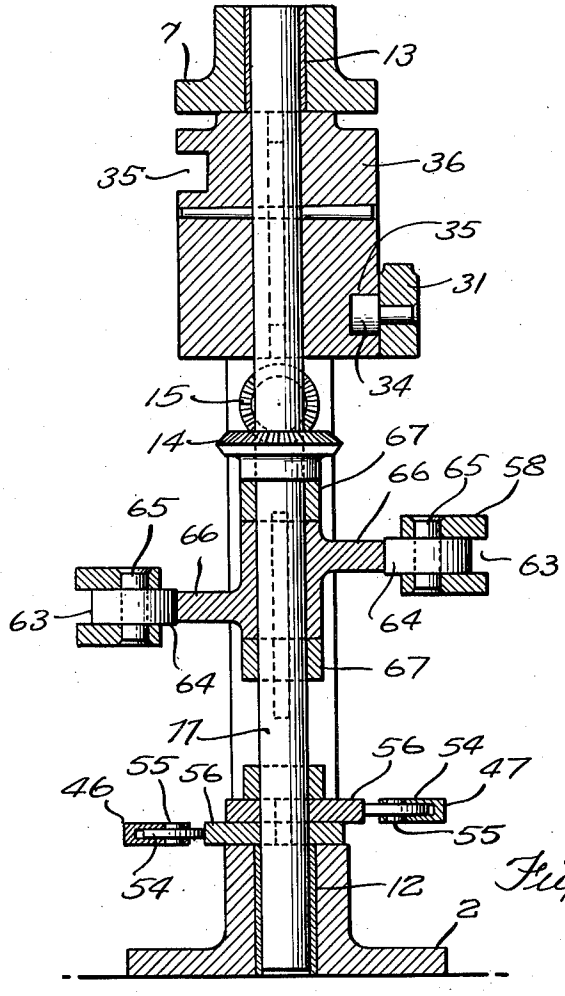


Fig. 9.

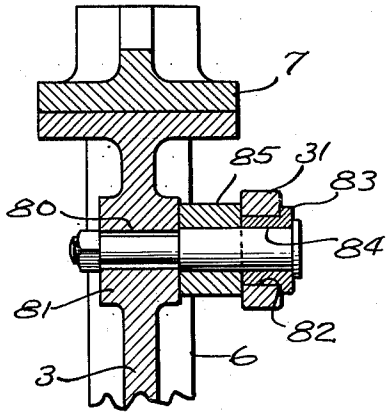


Fig. 8.

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Fig. 10.

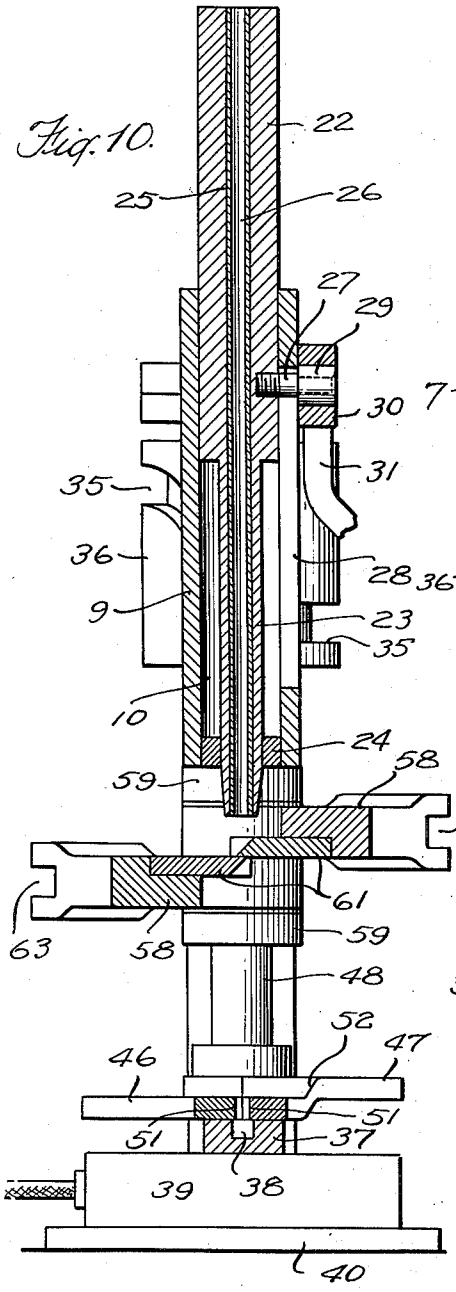
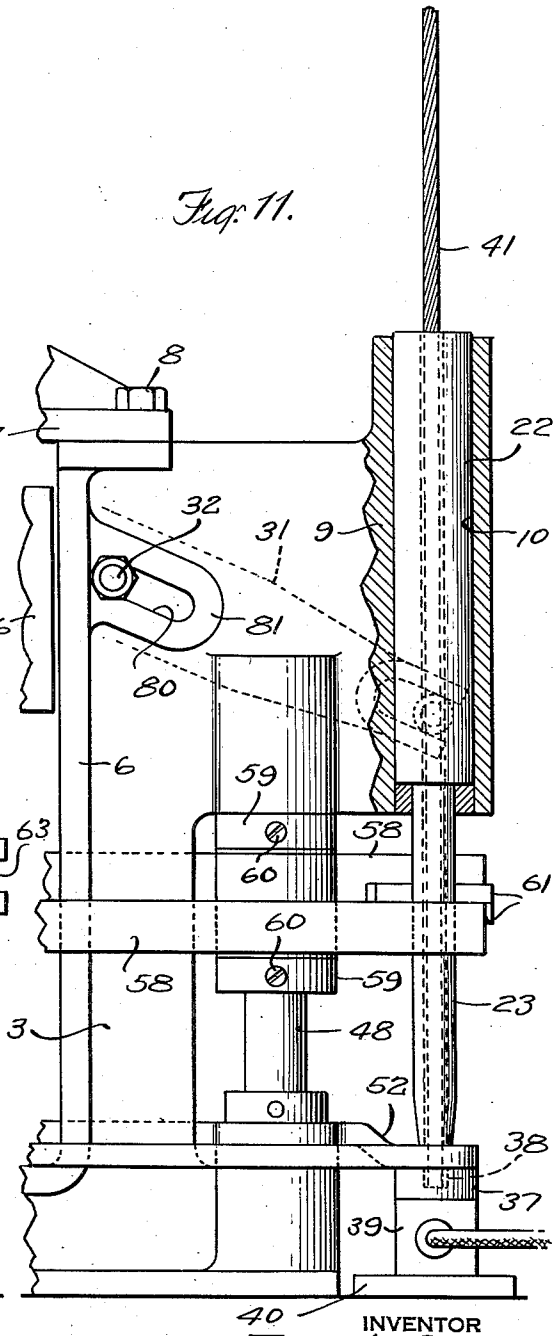


Fig. 11.



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UNITED STATES PATENT OFFICE

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BRISTLE TUFTING MACHINE

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Application November 30, 1946, Serial No. 713,341

9 Claims. (Cl. 300—2)

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This invention relates to a bristle tufting machine which automatically combines together a multiplicity of plastic bristles into tufts with the butt ends of the bristles fused together. The bristles may be made from any suitable plastic 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 or solidify when cooled. The tufts thus formed are particularly adapted for use in making tufted brushes. The tufts after leaving the tufting machine are secured in holders to form brushes. The securing of the tufts in the holders may be done either manually or automatically, depending on the type of brush being made.

The principal object of the invention is to provide a bristle tufting machine which will automatically combine a multiplicity of plastic bristles into tufts with their butt ends all fused together.

Another object of the invention is to provide a machine of this character which is of simple construction and very efficient in operation.

Another object of the invention is to provide a machine of this character which can be quickly and easily adjusted to form bristle tufts of any desired length within the limits of the machine.

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

Fig. 1 is a side elevation of a machine, constructed according to my invention, showing the various parts thereof in the positions they assume after a predetermined length of a rope of plastic bristle strands has been fed forwardly to bring the end thereof into contact with a suitable heater;

Fig. 2 is a top plan view of the machine shown in Fig. 1;

Fig. 3 is a horizontal section, through the machine, taken on the line 3—3 of Fig. 1 just above the shearing mechanism and showing the shears in their closed position or the position they assume just after having cut a predetermined length from the rope of bristle strands;

Fig. 4 is a view similar to Fig. 3 showing the shears in their open position ready for another predetermined length of rope to be fed thereby;

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 1 just above the clamping jaws which clamp and hold the end of the rope in contact with the heater while the rope feeding mechanism is retracting preparatory to advancing another predetermined length of rope;

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Fig. 6 is a view similar to Fig. 5 showing the clamping jaws in their open position;

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 1 showing the operating arm for the rope feeding mechanism in mid position;

Fig. 8 is a fragmentary section taken on the line 8—8 of Fig. 7;

Fig. 9 is a vertical section taken on the line 9—9 of Fig. 1, showing the relation of the various operating cams to each other;

Fig. 10 is a vertical section taken on the line 10—10 of Fig. 1 showing the relation of the rope feeding mechanism, the shearing mechanism and the clamping jaws to each other;

Fig. 11 is a fragmentary sectional side elevation of the forward end of the machine showing the rope feeding mechanism in its lowermost position or the position it assumes after having fed forwardly a predetermined length of rope;

Fig. 12 is a development of the drum cam which operates the rope feeding mechanism in timed relation to the rest of the machine;

Fig. 13 is a detail plan view of one of the clamping jaw operating cams; and

Fig. 14 is a perspective view of one of the tufts formed by the machine.

This machine is designed to form bristle tufts from a long rope of bristle strands. 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 as shown in Figs. 5 and 11. 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. 11 back to its initial position as shown in Fig. 1. 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 the drawings by reference characters, the numeral 1 indicates generally a frame which supports the various mechanisms which make up the machine. The frame 1 consists of a base 2 and an upwardly extending web 3 which is secured thereto. The web 3 has an upwardly extending open ended cut-out position 4 near the rear end thereof and an open ended forwardly extending cut-out portion 5 in the forward end thereof. A flange 6 formed integrally with the web 3 extends outwardly from each side thereof around the cut-out 4. The upper end of the cut-out 4 is closed by a cap 7 which is secured in place by bolts 8. The forward end of the web 3 above the cut-out 5 terminates in an enlarged section 9 having a vertically extending open ended cylindrical bore 10 therein.

A vertical cam shaft 11 by which all of the various mechanisms of the apparatus are operated in timed relation to each other is rotatably supported, by bearings 12 and 13, within the cut-out 4. The cam shaft 11 has a bevel gear 14, rigidly secured thereto, which meshes with a bevel gear 15 secured to the forward end of a horizontal shaft 16 rotatably supported in a bearing 17. A spur gear 18 which is secured to the rear end of the shaft 16 meshes with a spur gear 19 secured to a shaft 20 extending out from a gear case 21. The cam shaft 11 is constantly driven at the proper speed from the shaft 20 through the gears 19 and 18, shaft 16 and bevel gears 15 and 14.

A feed slide 22, having a reduced cylindrical extension 23 which extends out through a plug 24 in the lower end of the bore 10, is slidably mounted in the bore 10. The slide 22 has an axial bore 25 in which is secured a liner 26 of suitable wear resistant material such as chrome nickel steel. A stud 27 which is carried by the slide 22 extends out through a vertically extending elongated slot 28, in one side of the enlarged section 9, and has mounted on the outer end thereof a roller 29. The roller 29 is engaged by the bifurcated end 30 of a lever 31 which is pivotally supported by a stud 32. The other end of the lever 31 has a stud 33 secured thereto which carries a roller 34 which is adapted to ride in the cam track 35 in a drum cam 36 secured to the upper end of the cam shaft 11. As the cam shaft 11 and cam 36 rotate, the lever 31 will be oscillated on the pivot stud 32, making one complete oscillation for each rotation of the cam 36. The lever 31 will in turn reciprocate the feed slide 22. The cam track 35 is so shaped that the slide 22 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 37 having a cup shaped recess 38 therein is disposed in axial alignment with the feed slide 22. The disc 37 is supported and heated by a suitable electric heating unit 39 which rests on a heat insulating strip 40.

A rope 41 made up of a multiplicity of long plastic bristle strands is threaded through the liner 26 until the end of the rope extends out of the lower end of the liner a short distance. The rope 41 is frictionally engaged by the liner 26 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 26 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. 1 to the position shown in Fig. 11, carrying the rope with it until the projecting end enters the cup shaped recess 38 with the ends of the strands in contact with the heating disc 37. Just as the feed mechanism reaches the lower limit of its movement the jaws of a clamping mechanism generally indicated by the numeral 42 are brought together and firmly clamp or grip the end of the rope between them just above the heating disc 37. At the lower limit 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 41 which is held from movement by the clamping mechanism 42. 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 43 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 44, is removed from the machine. During the time the end of the rope was held in contact with the heating disc 37 the ends of the bristle strands melted and fused together. As the tuft 44 is removed from the machine the melted lower end thereof quickly cools and solidifies into a thin sheet, as indicated at 45 in Fig. 14, 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 Figs. 5, 6 and 13 comprises a pair of opposed levers 46 and 47 which are pivotally mounted upon a supporting shaft 48 intermediate their ends. The shaft 48 is supported in suitable sockets 49 and 50 in the web 3 and extends across the cut-out portion 5 of the web. The forward ends of the levers 46 and 47, which constitute the clamping jaws, each has an opposed semicircular recess 51 in the edge thereof. The radius of each of these recesses 51 is substantially the same as the radius of the rope being used and when the jaws are closed as shown in Fig. 6 the center of these recesses is coincident with the axis of the feed slide 22. The levers 46 and 47 are mounted one above the other upon the shaft 48 as shown in Figs. 1, 10 and 11. In order to bring the forward ends of these levers into register with each other the lever 47 is bent downwardly the thickness of the lever 46 as indicated at 52. The rear end of each of the levers 46 and 47 is recessed, as indicated at 53, and has a roller 54 mounted therein upon a stud 55 extending across the recess 53. The rollers 55 are engaged by cams 56 upon the cam shaft 11. The cams 56, which are identical with each other, are disposed one above the other in opposite phase upon the cam shaft 11. The upper cam 56 operates the lever 47 and the lower cam 56

operates the lever 46. These cams which are shown in detail in Fig. 13 are so shaped that the jaws will be held closed, as shown in Fig. 5, during the first 150° rotation of the cam, will open during the next 60° rotation of the cam shaft 11, 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 57 is provided to open the clamping jaws.

The shearing mechanism 43 comprises a pair of identical opposed levers 58 which are mounted one above the other upon the shaft 48 between collars 59 which are held in position upon the shaft 48 by set screws 60. Each lever 57 has a shear blade 61, having a semi-circular cutting edge 62, secured to the forward end thereof. The rear end of each of the levers 58 is bifurcated, as indicated at 63, and has a roller 64 mounted therein upon a stud 65. The rollers 64 are adapted to be engaged by cams 66 disposed one above the other in opposite phase upon the cam shaft 11 between collars 67 which are held in position upon the cam shaft 11 by set screws 68. The cams 66 are so shaped that they will operate the levers 58 to move the cutting edges 62 of the shear blades 61 from the position shown in Fig. 4 to the position shown in Fig. 3 to cut the rope during 73° rotation of the cam shaft 11, will let the shear blades move back to open position under the influence of suitable spring means 69 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. 4 during the next 214° rotation of the cam shaft 11. It is during this 214° dwell that the feed slide 22 moves from the position shown in Fig. 1 down to the position shown in Fig. 11 and back to the position shown in Fig. 1.

A development of the drum cam 36 which operates the feed slide 22 through the lever 31 is shown in Fig. 12. From this view it will be seen that the cam track 35 comprises upper and lower straight sections 70 and 71 respectively which are connected by inclined sections 72 and 73. The lower section 71 extends 146° around the cam 36 and the upper section 70 extends 64° around the cam 36 diametrically opposite the section 71. The sections 72 and 73 each extend 75° around the cam 36. From Figs. 1 and 12 it will be seen that the section 71 will cause the feed slide 22 to dwell at the upper limit of its movement during 146° rotation of the cam shaft 41; and that the section 70 will cause the feed slide to dwell at the lower limit of its movement during 64° rotation of the cam shaft 11. It will also be apparent that the slide 22 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 11.

In order to adjust the apparatus for making tufts of different lengths, provision is made for varying the stroke of the feed plunger 22 and the position of the shearing mechanism 43. 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 39 and heating disc 37 with which the end of the rope 41 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 32 both with respect to the

frame 1 and the lever 31. Changing the position of the stud 32 with respect to the lever 31 increases or decreases the stroke of the slide 22, 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 32 is adjustably mounted in an elongated slot 80 through a thickened portion 81 of the web 3. This slot slopes downwardly to the right as shown in Figs. 1 and 11. The lever 31 has an elongated slot 82 therethrough in which is slidably mounted a block 83 having a bore 84 for the reception of the stud 32 (see Figs. 7 and 8). The stud 32 also extends through a spacing collar 85 which maintains the lever 31 in proper position with respect to the cam 36 and feed slide 22. The block 83 is adjusted and maintained in position in the slot 82 by a screw 86 which is mounted in a threaded aperture 87 in a boss 88, adjacent one end of the slot 82, and has one end thereof rotatably mounted in a T-slot 89 in the block 83. The boss 88 is slotted as shown at 90 and a bolt 91 is provided for clamping the screw 86 in adjusted positions.

The position of the shearing mechanism is adjusted by loosening the set screws 60 and raising or lowering the levers 58 upon the pivot shaft 48 in accordance with the adjustment of the feed slide 22. The position of the cams 66 upon the cam shaft 11 must also be changed in accordance with any change in position of the levers 58. This is accomplished by loosening the set screws 68 and moving the cam up or down on the shaft 11 as desired. In the drawings 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 simple and efficient mechanism for accomplishing the objects of the invention. It is to be understood that I am not limited to the specific construction shown and described herein as various modifications may be made thereto within the scope of the appended claims.

I claim:

1. In a device of the character described the combination of a heating element, a reciprocable slide operative to successively advance the end of a rope of plastic bristle strands into contact with said heating element, means for clamping and holding said rope while said slide is returning to its initial position, means for successively cutting the advanced length from said rope, and means for operating said reciprocable slide, said gripping and holding means and said cutting means in timed relation to each other.

2. In a device of the character described the combination of a reciprocable slide operative to successively advance predetermined lengths of a rope of plastic bristle strands, means for applying sufficient heat to the advanced end of said rope to fuse the ends of the bristles together, means for reciprocating said slide, and means for varying the length of the stroke of said slide.

3. In a device of the character described the combination of a heating element, a reciprocable slide operative to successively advance predetermined lengths of a rope of plastic bristle strands into engagement with said heating element, means for gripping and holding the end of said rope in contact with said heating element while said reciprocable slide is returning to its initial

position, means for successively cutting said advanced lengths from said rope, a cam shaft having a plurality of cams secured thereon, operative connections between said cams and said reciprocable slide, said gripping and holding means and said cutting means through which said reciprocable slide, said gripping and holding means and said cutting means are operated in timed relation to each other, and means for rotating said cam shaft.

4. In a device of the character described the combination of a heating element for applying heat to the end of a rope of plastic bristle strands to fuse the ends of the strands together, a reciprocable slide operative to advance the end of said rope into engagement with said heating element, and means for reciprocating said slide and causing a dwell in its movement at each end of its stroke.

5. In a device of the character described the combination of a heating element for applying heat to the end of a rope of plastic bristle strands to fuse the ends of the strands together, a reciprocable slide operative to advance the end of said rope into engagement with said heating element, means for reciprocating said slide and causing a dwell in its movement at each end of its stroke, and means for varying the length of the stroke of said slide.

6. In a device of the character described the combination of a heating element, a reciprocable slide operative to successively advance predetermined lengths of a rope of plastic bristle strands into engagement with said heating element, means for gripping and holding the end of said rope in contact with said heating element while said reciprocable slide is returning to its initial position, means for successively cutting said advanced lengths from said rope, a cam shaft having a plurality of cams secured thereon, operative connections between said cams and said reciprocable slide, said gripping and holding means and said cutting means through which said reciprocable slide, said gripping and holding means and said cutting means are operated in timed relation to each other, means for rotating said cam shaft, and means for varying the length of the stroke of said slide.

7. In a device of the character described the combination of a heating element for applying heat to the end of a rope of plastic bristle strands to fuse the ends of the strands together, a reciprocable slide operative to advance the end of said rope into engagement with said heating element, means for cutting sections from said rope after each advance of said rope by said slide, means for varying the length of the stroke of said slide, and means for adjusting the position of said cutting means.

8. In a device of the character described the combination of a heating element for applying heat to the end of a rope of plastic bristle strands to fuse the ends of the strands together, rope advancing means operative to successively advance the end of said rope into engagement with said heating element, and means for operating said rope advancing means and causing a dwell in its movement at the end of each advancement.

9. In a device of the character described the combination of a heating element for applying heat to the end of a rope of plastic bristle strands to fuse the ends of the strands together, rope advancing means operative to successively advance the end of said rope into engagement with said heating element, means for operating said rope advancing means and causing a dwell in its movement at the end of each advancement, and means for varying the distance the end of said rope is advanced by said rope advancing means.

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