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2,587,792

METHOD FOR ROUNDING THE TIPS OF BRISTLES

Filed Aug. 13, 1947

2 SHEETS—SHEET 1

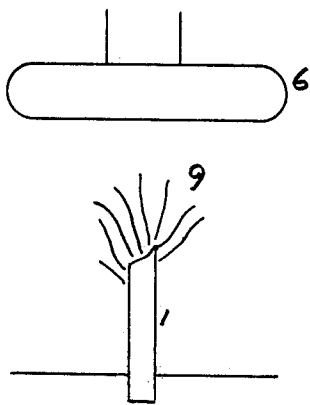


Fig. 1

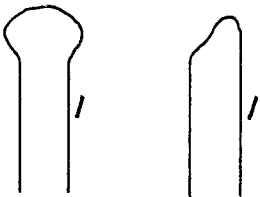


Fig. 2 Fig. 3

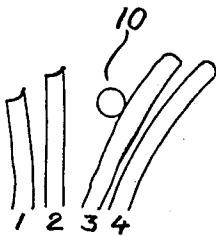


Fig. 4

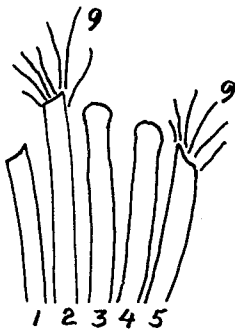


Fig. 5

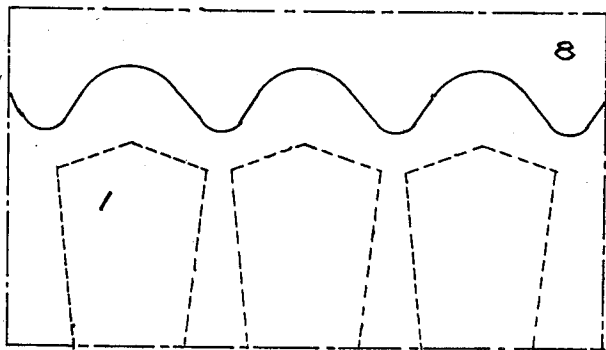


Fig. 6

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2 SHEETS—SHEET 2

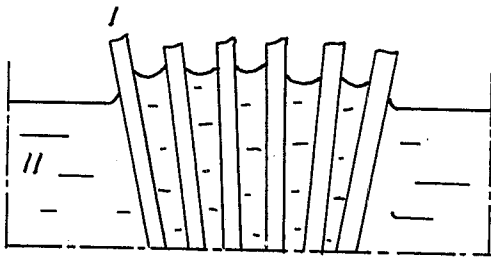


Fig. 7

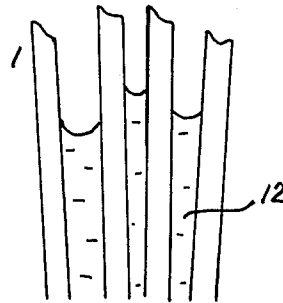


Fig. 8

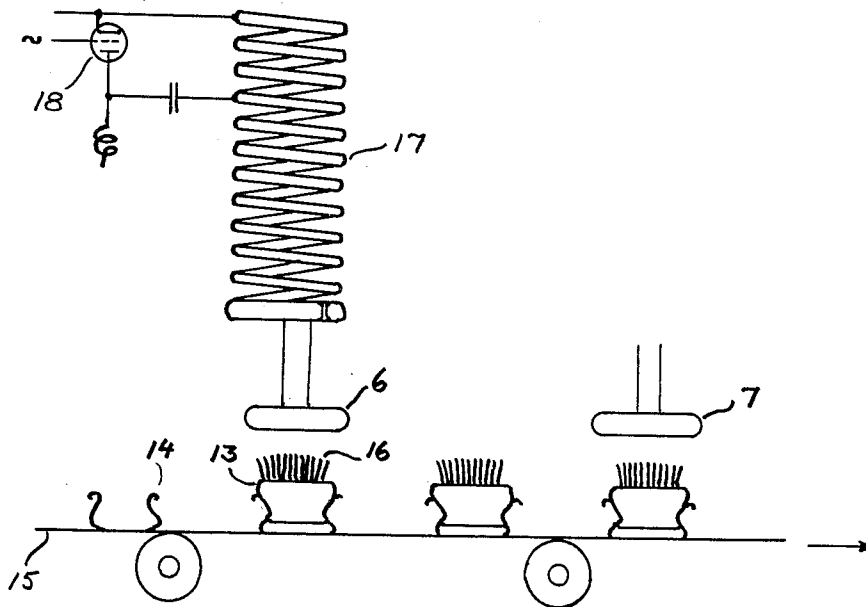


Fig. 9

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UNITED STATES PATENT OFFICE

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METHOD FOR ROUNDING THE TIPS OF BRISTLES

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8 Claims. (Cl. 219—15)

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This invention relates to a method for rounding the tips of wires of thermoplastic materials, especially bristles of plastics for brushes, and has for its object to accomplish the rounding in a quick and economical way.

It is well known to make brushes with rounded tips, for instance according to the British Patent Number 2980 of the year 1895. The tips have usually been rounded in order to prevent damage to the skin when the brushes are used, and the rounded tips are especially necessary on tooth- and hair-brushes made of hard bristle, for instance of nylon and the like. The rounding of the tips is generally performed by grinding, which is a tedious operation which for best results requires that every bristle be ground separately before assembling the complete brush. Heating the bristle in order to round the tips by means of a hot body placed near the tip or by means of a flame would heat also at least a length of the lower parts of the bristle, which for most materials would make the bristle less stiff after the treatment.

The principles of the invention, and several ways of practicing the same, are illustrated diagrammatically in the accompanying drawings, forming a part hereof, and in which:

Fig. 1 is a view illustrating one method of practicing the invention,

Figs. 2 and 3 are enlarged views of bristles showing different degrees of rounding accomplished by the invention,

Fig. 4 illustrates diagrammatically the effect of combing the bristles during treatment,

Fig. 5 illustrates the effect of timing the discharge in consecutive pulses in order to round certain of the bristles selectively,

Fig. 6 illustrates the use of an especially shaped electrode,

Fig. 7 is a diagrammatic view illustrating the use of the invention in connection with liquid immersion,

Fig. 8 is a similar view illustrating the effect of dipping the bristles in a liquid prior to treatment, and

Fig. 9 illustrates diagrammatically one way of applying the invention to the treatment of brushes or the like carried on a conveyor.

According to my invention only the tip of the bristle is heated to such a temperature that the tip softens or melts and contracts by surface tension to a rounding whose mean diameter may be chosen from less than the diameter of the bristle to larger than said diameter by means of the use of more or less heat and time of treat-

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ment. In the latter case the bristle gets a small ball on the tip. In order to heat only the very tip of the bristle to about the melting temperature, and as shown in Fig. 1, the heating is performed by a concentrated electric discharge 9 formed between the tip of the dielectric or conducting bristle 1 as one electrode and another electrode 6 with much larger radius than the tip of the bristle. The tip of the bristle 1 will thus act as a point-electrode giving a concentration of the electric field lines near the tip. The outer electrode 6 may be very distant, that is producing in effect a discharge into free space, or it may be placed comparatively near the tip. In the latter case it may be shaped according to the configuration of a completed brush in order to give a uniform discharge over the surface of the brush. The rounding may in some cases be performed by burning away material from the tip.

Figs. 2 and 3 illustrate variations in the shape of the rounded end which can be obtained on a bristle 1; Fig. 2 shows only a slight rounding of the sharpest spots, while Fig. 3 shows the production of a ball tip.

For some purposes, especially for bristles of metal, a direct current source may be used but when handling bristles of dielectric material it is advantageous to use a high-frequency source with such a high frequency that the bristle acts as a dielectric conductor. The frequency may furthermore be chosen with respect to the material of the bristle so that the dielectric losses in the lower part of the bristle because of the current will not heat this part unduly.

In a completed brush the bristles are often not of the same height and the tips are not uniformly distributed on the surface formed by the tips. In this case it is useful to time the discharge in consecutive pulses of predetermined length in order to round the most protruding tips first, then to let these cool off. This procedure is illustrated in Fig. 5, in which bristles 2 and 5 are rounded during one application of the electric field, the bristles 3 and 4 having previously been rounded by a different application. When high tension is applied for the next time the electric field lines will be most concentrated near some lower tips 1 which now are more pointed than the first treated tips and will attract the discharge and so on in successive operations. The successive voltages may have different magnitudes and frequencies in order to properly select successive layers of tips to render as many as possible of the tips in the brush rounded and especially the most protruding ones. In order that the dis-

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charge shall reach also the tips of very short bristles the bristles may be combed in order to separate them during the treatment. Fig. 4 illustrates this combing operation as accomplished by a pin 10 which is shown bending the rounded bristles 3 and 4 from the rough bristles 1 and 2, thereby to allow the field to be concentrated on these latter, which would otherwise be shadowed by the longer bristles 3 and 4.

During the operation the bristle or the completed brush should be held by an electrode such as 8 in Fig. 6 which in the latter case should be shaped to give the whole surface of the back the same distribution of electric field lines or an intentional gradation in the distribution. The separate bristle or the bunch of bristles or the complete brush may also be immersed into a liquid 11 (as in Fig. 7) during the treatment with only the tips above the surface. The liquid should preferably have a comparatively high dielectric constant. The liquid acts both to cool the lower parts of the bristle and to form the electrode. By surface tension the liquid also separates the bristle which lessens the risk that the tips can melt together. By a suitable timing of the discharge this risk is in any event small, and the occurrence of a small percentage of bristles melted together may in some cases not be too objectionable which may speed up the production. If the bristles are immersed in a suitable liquid the vapour formed when the tips are heated tends to separate the tips or may tend to make them less liable to clog together and can also prevent oxidation. The bristles or the brush may also only be dipped in a liquid before treatment in order to obtain some of the effects as described above; such a liquid 12 is shown in Fig. 8 as remaining in the interstices between the bristles 1.

The mean power needed for this method is comparatively low as the losses are concentrated at the area near the tips. It should be generated by a tube oscillator with a tuned step-up secondary circuit.

The operation can easily be adapted for mass production by the use of an endless belt with holders for several brushes and is very fast as the time of treatment is of the order of seconds only. Fig. 9 illustrates this use of an endless belt, designated by numeral 15, which carries the brushes 13 as by spring clips 14 so that the bristles 16 can attract the discharge from the electrodes 6 and 7. The belt may have continuous or intermittent movement. The high frequency supply for electrode 6 only is shown, and may comprise a tuned resonant circuit 17 fed by an electron tube 18 which may either be driven from a suitable oscillating source, or may be self-oscillating as well understood in the electronic art. Obviously, conventional means may be employed for energizing the electrodes, for example, under control of a contact operated by movement of the belt 15. The details of such mechanism form no part of the present invention.

I claim:

1. A method of treating small diameter articles such as wires, bristles, and the like to provide rounded ends thereon, comprising providing an

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electrode maintained at a distance from the end of such an article, establishing an electric circuit between said article and said electrode, and energizing said circuit to provide a corona discharge in the neighborhood of the end of said article whereby to heat said end locally and melt the same to the desired rounded form.

2. The method in accordance with claim 1, including the step of concentrating the discharge current in the region adjacent said end of said article.

3. The method in accordance with claim 1, in which said circuit is energized with a direct current potential.

4. The method in accordance with claim 1, in which said circuit is energized by a high-frequency electric potential.

5. The method in accordance with claim 1, including the step of regulating the time of action of said discharge in accordance with the length of the article being treated.

6. The method of rounding the tips of bristles and the like comprising providing an electrode spaced from said bristles and having an effective radius which is large compared to the radius of a bristle, and establishing a concentrated corona discharge between the bristles and said electrode to heat the end of each bristle sufficiently to melt the same without raising the remainder of said bristle to its melting temperature.

7. The invention in accordance with claim 6, including the step of immersing the bristles in a liquid in such a way that their ends facing said electrode protrude from the said liquid.

8. The method of rounding the tips of a plurality of bristles in an assembly in which the bristles are of unequal lengths, comprising providing an electrode maintained at a distance from the ends of said bristles, establishing an electric circuit between said electrode and said bristles and intermittently energizing said circuit to provide a corona discharge adjacent the tips of successively shorter ones of said bristles in response to the lessening of the electric field strength at the ends of the longer of said bristles due to the rounding thereof under the influence of the discharge.

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