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G. H. WANDEL ET AL

2,426,328

METHOD OF FINISHING PLASTIC FILAMENTS AND PRODUCTS MADE THEREFROM

Filed June 5, 1943

Fig. 2.

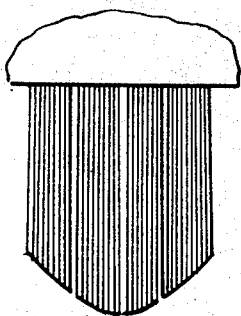


Fig. 1.

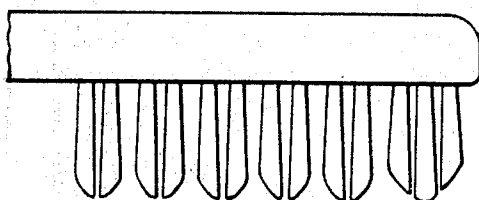


Fig. 3.

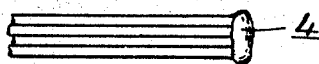
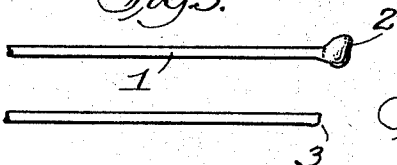


Fig. 5.

Fig. 4.

Fig. 10.

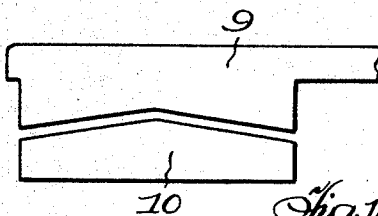


Fig. 12.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

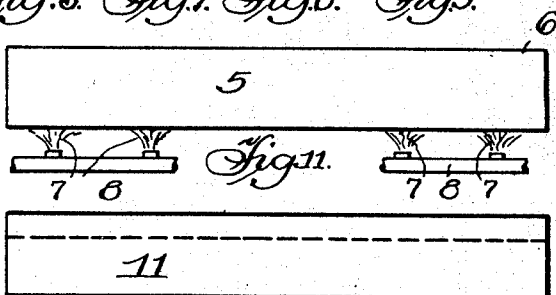


Fig. 13.

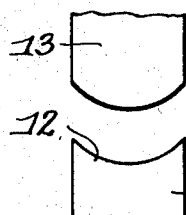


Fig. 14.

Fig. 15.

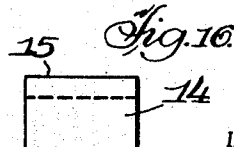
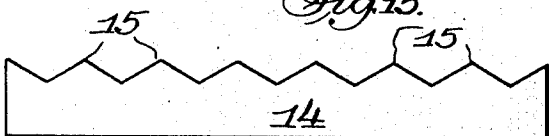


Fig. 16.

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UNITED STATES PATENT OFFICE

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METHOD OF FINISHING PLASTIC FILA-
MENTS, AND PRODUCTS MADE THERE-
FROM

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This invention relates to a method of finishing plastic filaments, and products made therefrom, and particularly to such filaments when used in brushes. While it applies generally to many kinds of brushes for different uses it is particularly adapted to tooth brushes. We, however, wish it understood that the invention is not limited to tooth brushes even though for illustrative purposes we have shown and described it largely in connection therewith.

One of the important problems in connection with the manufacture of brushes is the shaping of the ends of the bristles and of the ends of the tufts of bristles so that they will be efficient in operation, economical in manufacture and may be quickly and easily formed with the most advantageous shapes.

In the present invention we have discovered that the most effective manner of shaping and finishing the ends of the bristles and of the bristle tufts is by applying sufficient heat to the ends of the bristles to cause them to melt and at the same time to assume the general contour desired for the active face of the brush. In making our brushes we use synthetic bristles which may be purchased on the market under the general name of nylon bristles. While, for descriptive purposes, we refer to nylon bristles, we wish it understood that we may use any synthetic bristles that are adapted to have their ends melted by heat in accordance with the spirit of the present invention, as for example bristles made of plastic belonging to the group of thermoplastics.

It has been known in the manufacture of brushes, particularly tooth brushes, to insert into handles multiple tufts of bristles, the length of which are uniformly longer than desired in the finished brush, and then to trim the surface to the desired length and contour by cutting the bristles. This procedure tends to produce ragged ends and particularly if the shearing knives become somewhat dull which tends to give a trim lacking the desired symmetry. Also, when trimming the bristles by grinding against an abrasive rather than shearing by knives, which has been presumed to produce a round end tip on the bristles, the abrasion or grinding is suitable only to round the end of the bristles which have already been cut approximately to contour, and consequently many ragged ends escape the rounding by abrasion. In the present invention we have made possible a practical method of achieving a bristle finishing operation without either cutting or grinding.

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While not wishing to limit ourselves thereto, one manner of applying heat to the ends of the bristles for shaping them is to provide a plate or plates of the desired shape, heat these plates to the desired temperature, and bring the free ends of the bristles into contact with the heated plate having the desired shape, and melt the bristle ends to the desired outline. When a free end of a bristle more or less segregated from the adjacent bristle ends, contacts the heated plate, or other means for applying heat, and becomes melted at its end, the melted material withdraws into a ball remaining affixed to the bristle stalk. Under suitable conditions of temperature and nature of contact surfaces applying the heat, the ball of material and the bristle itself remain of the original color. When a group of bristle ends in close proximity to each other are contacted with the heat and the ends melted, said ends coalesce and become united together.

Whether the bristle ends individually have a ball formed thereon, or a group of said ends are coalesced together after being melted, it is necessary to remove such balls or coalesced portions, which is preferably done by combing, picking, brushing or the like. We have found a very satisfactory way to remove said balls and coalesced portions to be to comb the bristles with a steel brush. The removal of these balls or coalesced portions leaves the free ends of the bristles in a very highly desirable condition for brushing, either as a tooth brush, or general purpose brush, the shape of which bristle free ends is largely controlled by the manner of applying the same against the heated plate or other heating medium. For example, when the heating medium is a flat plate the ends of the bristles may be given an angular slant by applying the end against the heated plate at an angle, more or less flat by a corresponding application against the flat plate, curved by using a curved plate, or variously contoured by using a correspondingly contoured plate.

Among the objects of our invention are to overcome the disadvantages, and make possible the advantages, referred to above.

Other objects, advantages and capabilities will later more fully appear.

While we have shown and described preferred features of our invention we wish it understood that the same are susceptible of modification and change without departing from the spirit of our invention:

In the drawings:

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Fig. 1 is a diagrammatic fragmentary side elevation of a tooth brush embodying our invention.

Fig. 2 is an enlarged fragmentary portion of a brush body showing in end elevation a plurality of bristle tufts embodying our invention.

Fig. 3 is a side elevation of a single bristle showing the ball formed on the end thereof as the result of applying heat to the end of the bristle sufficient to melt it.

Fig. 4 is a view similar to Fig. 3 but showing the same bristle after the ball has been removed.

Fig. 5 is a side elevation of a plurality of bristles in close proximity to each other, showing how the material of the ends of the bristles coalesces together after being heated to the melting point.

Fig. 6 is a fragmentary side elevation of an end portion of a bristle that has had its end applied to a more or less flat heated plate at an angle, the bristle end being heated to the melting point, and the ball, or melted material, on the end of the bristle removed.

Fig. 7 is a view similar to Fig. 6 but showing a slightly different shape of bristle end.

Fig. 8 is a view similar to Fig. 7 but showing a still different shape of bristle end.

Fig. 9 is a fragmentary longitudinal section of a bristle having cups, depressions or irregularities in the end surface.

Fig. 10 is a plan view of Fig. 9.

Fig. 11 is a side elevation of a plate having a flat surface that can be heated to a temperature capable of melting the bristle end when contacting the plate.

Fig. 12 is a side elevation of a further shape of plate, showing diagrammatically a brush which has been contacted with the heated plate to give the bristle ends a general contour similar to that of the face of the plate.

Fig. 13 is a side elevation of a plate having a groove extending longitudinally along the active face of the plate.

Fig. 14 is an end view of the plate of Fig. 13 and showing slightly spaced thereabove diagrammatically a portion of a brush, the ends of the bristles of which have been contacted with the grooved face of the heated plate and the bristle ends melted to the same general shape of the plate.

Fig. 15 is a side elevation of a still further shape of plate.

Fig. 16 is an end elevation of the plate shown in Fig. 15.

We preferably purchase our bristles on the market under the name of nylon bristles. These come in long strands and are cut into the desired lengths, and the tufts of bristles suitably secured in holes in the brush body. The free ends of the bristles are, if desired, then roughly given the general desired contour by scissor or knife trimming or by any other suitable rough trimming method desired. While nylon bristles are preferred we wish it understood that our invention is not limited thereto, but any suitable synthetic plastic bristles made of a material belonging to the group of thermoplastics may be used as desired.

As shown in Fig. 3 when a single bristle, 1, of synthetic thermoplastic material is heated to the melting point and then permitted to solidify, a ball, 2, is formed on the end of the bristle. When this ball is pulled off by any mechanical means such as combing, picking, brushing or the like, the end of the bristle immediately under the ball will assume any one of a variety of shapes depending upon what angle or position the bristle

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end was presented to the face of the plate or other means for applying heat to the bristle end. One shape for such bristle end is shown at 3 in Fig. 4.

The fact that a clean and smooth surface fracture results when the melted portion is pulled away from the stalk is believed to be because of a definite difference in chemical structure between the melted material and the unmelted remainder of the stalk, as for example, in the case of nylon, the strands are so manufactured that there is a definite crystal orientation. When the end of the stalk is melted the melted portion loses this typical orientation. There is therefore a distinct plane of division between the oriented stalk and the disoriented melted portion, and this serves as a plane of cleavage when the melted material is broken off.

When a group of bristles in more or less close proximity to each other have their ends applied to heat sufficiently to melt them, such melted ends after solidifying will be coalesced together as shown at 4 in Fig. 5. When these coalesced portions are pulled off by any suitable mechanical means such as mentioned above in connection with Fig. 3, an end will be formed on each bristle of any one of many shapes depending upon the particular angle or position the bristle end was presented to the plate face or other heating means. Some of these general shapes are shown in Figs. 4 to 9 inclusive. Also other shapes of bristle ends may result, some of which are seen in Fig. 2. Regardless of the particular shape of the bristle end, they will always be of a shape to effectively hold and apply tooth paste or other material that may be used on the brush bristles.

While our invention is not limited to tooth brushes, we have shown it as so applied in Fig. 1 in which the general contour of the free ends of the bristle tufts may be shaped by contact with a heated plate of the desired shape as later more fully described. The arrangement of bristles in Fig. 2 may be applied to a tooth brush or a general purpose brush as desired.

An important feature of our invention is the shaping of the ends of brush bristles by applying them to plates having faces of the desired shape and heated to a temperature sufficiently high to melt the ends of the bristles when touched to the plate face so that the ends of the bristles will be thus brought to the general contour desired and as defined by the heated plate face. A simple form of such plate is shown in Fig. 11 as having a body portion 5 and a flat top face 6. This plate will be preferably made of metal and will be heated to a temperature sufficiently high to quickly cause a melting of the material of the ends of the bristles when they are touched to the face of the plate. Such plates may be heated to the desired temperatures in any desired manner such as by the flame jets 7 fed from fuel of any desired and suitable kind supplied from any suitable source to the hollow head 8 and having openings leading to the flame jets. Many other means of heating such plates may be utilized without departing from the spirit of our invention.

In Fig. 12 we have shown a plate having a face of a shape to produce a brush having bristles longer at the ends of the head of the brush and inclining inwardly at the face of the brush toward the center as indicated by the brush 9, shown diagrammatically just above the plate 10, in Fig. 12. In other words the contour of the ends of the brush bristles is determined by the shape of the working face of the plate.

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In Figs. 13 and 14 we have shown a plate 11, having a longitudinal groove 12, along the working face to give a contour to the ends of the bristles as shown diagrammatically in the brush 13 just above the plate 11 in Fig. 14.

Figs. 15 and 16 show a plate 14 having saw-tooth ridges 15 extending transversely across the active face of the plate. As will be understood many different shapes of plates may be used thus giving a corresponding number of shapes available for the brush contours.

The plate in use must be hot enough to melt the bristle ends. From 200 to 220° C. is a typical melting point for nylon, but the temperature of the plate could be higher than the melting point of the bristle, and preferably will be to give a quicker melt when the bristles are in contact with the plate.

Commercially, in order to speed production, it is desirable to remove the balls 2 or the coalesced portions 4, immediately after the material of the ball or coalesced portions has sufficiently cooled to solidify the same.

As will be understood all that is necessary is to touch the bristle end of the brush against the face of the heated plate until the bristle ends are melted to bring them to the shape of the plate. A mere contact of the bristle ends against the plate will be sufficient for this. No great pressure is required.

As stated above various shapes of the ends of the bristles (after the balls or coalesced portions are pulled off) will be produced, depending on the position of the bristles with relation to the face of plate at the moment of contact. Fig. 6 shows an angular bristle end with slightly rounded edges. In Fig. 7 the end is angular without the rounded edges. In Fig. 8 is shown a more or less rounded end, and in Figs. 9 and 10 are shown a flat end having cups, depressions or irregularities in the end surface. Various other shapes may also be produced.

Our invention has many possibilities, a few of which may be mentioned as follows:

1. To so design a plate that by a single contact with a previously untrimmed brush a total overall design of contour can be achieved with a single melting operation.

2. The overall contour can be broken down into two or more simple contours such as by using a combination of the plates illustrated in Figs. 14 and 15. The plate shown in Fig. 14 would give a dome trim parallel to the length of the brush and prior or subsequent use of a plate like in Fig. 15 would give a series of pointed tufts. When two or more plates are used to produce stepwise contouring the melted portion in each step can be removed before the next step or allowed to accumulate and be removed in a single operation after the contouring is completed.

3. The final overall contour can be achieved by the successive use of a single heated plate of suitably small size which would be applied to different portions of the brush at varying angles and producing varying shortening of the stalk by melting.

4. Variations of contours may also be achieved by a single plate by moving the brush in contact with the plate as by rotating the brush against a flat plate to achieve a dome contour.

5. Also when desired for practical working of the invention the approximate finished contour may be produced in the brush head by any known method such as knife or other trim, leaving each bristle slightly longer than the final length de-

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sired, whereupon each bristle can be further shortened by the heat treatment described herein, thereby producing the finished contour in which each bristle has been given the smooth end typifying the invention.

6. Also by achieving the finished trim described earlier herein, by the use of plates which instead of having polished surfaces, have stippled or otherwise minutely and intentionally irregular surfaces. Each bristle tip can be given a surface other than plane or rounded, as for example one in which each bristle tip would have one or more minute smooth edged cups as seen in Figs. 9 and 10, which will aid in holding particles of dentrifice and thus increase the cleansing and polishing action of the brush-dentrifice combination. The ends of such bristles may also be a series of ridges or other smoothly contoured irregularities if desired.

It is very easy to break the ball from the end of the stalk, leaving a perfectly clean fracture which has the appearance of having been glazed and is in fact much smoother than brushes treated by the abrasion method. The tooth brush to which the bristles have been affixed but which have not been trimmed can be brought into contact with a heated surface, the temperature of which is adjusted to melt the bristles on contact without scorching them.

By shaping the heated surface or by contacting the brush against the heated surface in predetermined angles, the ends of the bristles can be melted to produce in each individual bristle the desired length and to produce in the brush as a whole the desired contour.

After this heat treatment a fair number of balls, plates, scales or other forms of accumulated melted material will remain adherent to the ends of the bristles and some of the melted material will fall away or adhere to the heating surface until brushed away.

The coalesced scab-like material adhering to the ends of the bristles is removed very simply after hardening by brushing for example with a stiff wire metal brush or comb or by scraping over an angular surface which will catch under the edges of the coalesced tips and break them off.

Regardless of the method used to remove the scab-like material, once removed it leaves the bristle tip in a clean and almost fire-polished condition.

Brushes treated in this way are much smoother to the feel, are much more regular in contour and are much more finished in appearance than brushes finished by any method heretofore known.

Having described our invention, we claim:

1. The method of finishing the free ends of thermoplastic bristles for brushes, which consists in melting the free ends of the bristles to the desired contour, there being left on the ends of the bristles after the melting enlarged, solidified portions of the bristle material, and then pulling off the enlarged solidified portions from the bristles which leaves the ends of the bristles in a clean, polished condition.

2. The method of forming and finishing the free ends of meltable brush bristles to the desired contour, which consists in providing a body capable of being heated and having a face formed with a contour like that to be imparted to the brush bristle ends, arranging the bristles into tufts and securing them to the brush head, trimming the bristle ends to approximately the desired contour, heating the contoured face of said body to a temperature capable of melting the

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bristle ends, and contacting the bristle free-working ends with said heated face until the free-working ends of the bristles are melted into the contour of the heated face.

3. The method of forming and finishing the free ends of meltable brush bristles to the desired contour, which consists in providing a body capable of being heated and having a face formed with a contour like that to be imparted to the brush bristle ends, arranging the bristles into tufts and securing them to the brush head, trimming the bristle ends to approximately the desired contour, heating the contoured face of said body to a temperature capable of melting the bristle ends, and contacting the bristle ends with said heated face until the ends of the bristles are melted into the contour of the heated face, said melting forming enlarged portions on the bristle ends, and pulling off the enlarged portions from the bristles when solidified to produce clean, polished ends on the bristles.

4. The method of producing clean, polished ends on the ends of thermoplastic brush bristles, and forming the bristle ends collectively with a pre-determined contour on the brush face, which consists in melting the bristle ends to said contour which causes enlarged portions to solidify on the bristle ends, and pulling said solidified enlarged portions away from the bristles.

5. The method of finishing plastic filaments for brushes, which consists in contacting the ends of the filaments with a heated surface to form the contour of the filament ends in one direction of the brush, and contacting the ends of the filaments with another heated surface to form the contour of the filament ends in another direction of the brush.

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6. The method of finishing plastic filaments for brushes in which the ends of the bristles have been previously trimmed to approximate contour, which consists in applying heat to the bristle ends to give them the desired final contour.

7. A brush having synthetic polymeric thermoplastic bristles the ends of which are smooth and formed with cup-like depressions to aid in holding cleansing material applied to the brush.

8. A brush having synthetic polymeric thermoplastic bristles the ends of which are smooth and provided with depressions to retain cleansing material applied to the brush.

9. A brush of the class described comprising in combination a body member and synthetic bristles fixed at one of their ends in said body member the ends of the bristles having been formed by bringing a plurality of bristles into contact with a heated plate of definite contour to secure the desired final contour of said plurality of bristles, the individual ends of the bristles having the desired shape and smoothness, the melted blobs caused by contact of said bristle ends with said heated plate having been removed from said ends.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,965,009	Stevens	July 3, 1934
267,957	White	Nov. 21, 1882
278,660	Estabrook	May 29, 1883
917,811	Strobel	Apr. 13, 1909