

May 23, 1950

J. J. REIS, JR

2,508,799

PAINTBRUSH AND SYNTHETIC BRISTLES FOR THE SAME

Filed Dec. 28, 1944

2 Sheets-Sheet 1

Fig. 1.

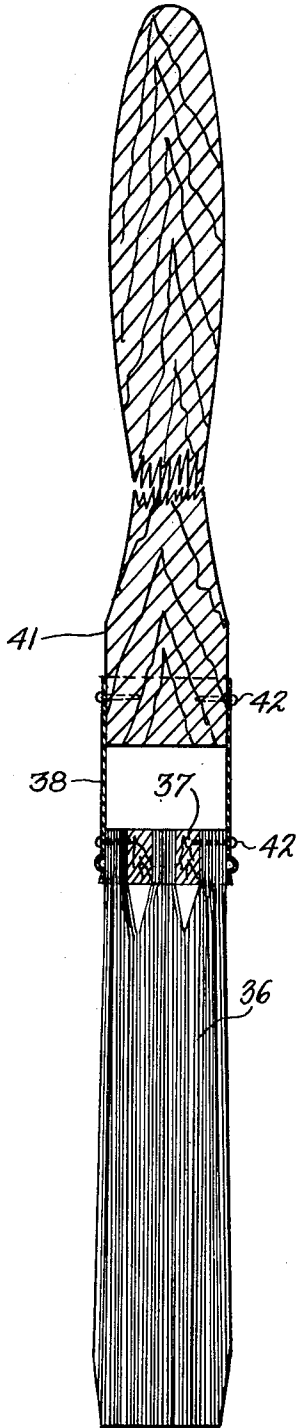


Fig. 6.

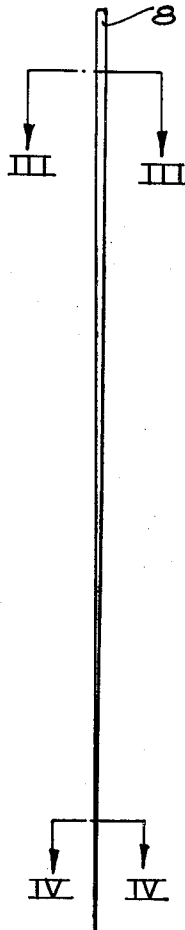


Fig. 7.

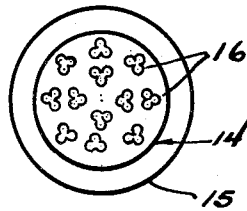
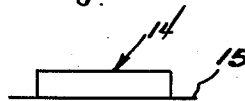


Fig. 8.



Inventor
JOSEPH J. REIS JR.

By

Olen E. Bee

Attorney

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J. J. REIS, JR

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2 Sheets-Sheet 2

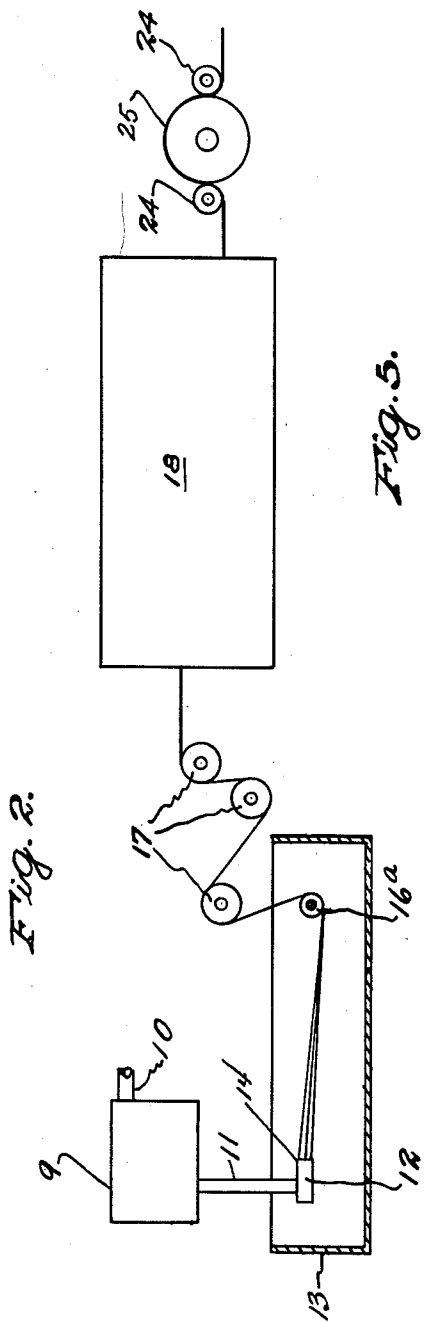


Fig. 2.

Fig. 5.

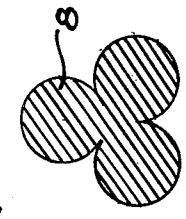
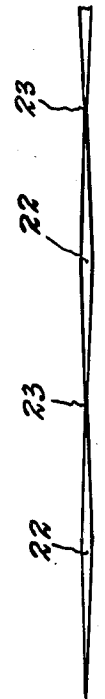


Fig. 4.



Fig. 3.

Inventor
JOSEPH J. REIS JR.

By Olen E. Bee
Attorney

UNITED STATES PATENT OFFICE

2,508,799

PAINTBRUSH AND SYNTHETIC BRISTLES FOR THE SAME

Joseph J. Reis, Jr., Baltimore, Md., assignor to Pittsburgh Plate Glass Company, Allegheny County, Pa., a corporation of Pennsylvania

Application December 28, 1944, Serial No. 570,146

7 Claims. (Cl. 15-159)

1

The present invention relates to synthetic bristles as substitutes for animal bristles in brushes, such as paint brushes and the like, and it has particular relation to brushes comprising synthetic bristles of cellulosic esters such as cellulose diacetate or cellulose triacetate, etc.

One object of the invention is to provide bristles which when assembled in a brush have a high capacity for retaining paint without running or spattering during brushing operations and which have properties more satisfactory for brushes generally than those heretofore employed.

A second object is to provide bristles which when assembled in a brush have relatively uniform resiliency in all directions in which the brushes are likely to be moved.

A third object is to provide an improved method of forming bristles of the foregoing character.

These and other objects of the invention will be apparent from consideration of the following specification and claims.

For better understanding of the invention, reference may be had to the drawings in which:

Fig. 1 is a sectional view of a brush constructed in accordance with the provisions of the invention.

Fig. 2 is a diagrammatic or schematic view of an apparatus suitable for use in the spinning of bristles embodying the provisions of the invention.

Figs. 3 and 4 are sectional views showing, on an enlarged scale, sections of bristles taken respectively upon the lines III-III and IV-IV of Fig. 6.

Fig. 5 is a fragmentary portion of a filament embodying a plurality of bristle sections before they are cut to length.

Fig. 6 is an elevational view of a single bristle cut from a filament.

Fig. 7 is a detail view of a plate having a plurality of spinnerette openings formed therein, said openings being of a shape to accord with the principles of the present invention.

Fig. 8 is a side elevational view of the plate shown in Fig. 7.

In the drawings, like numerals refer to like parts throughout.

As is well known, brushes such as are employed in the spreading of paint and other coating compositions conventionally are formed of animal bristles or hairs grouped together into brush or bristle portions and suitably attached to a handle. Animal bristles for such brushes, at least of the better types, are relatively circular in section and are also tapered from butt portion to

2

tip. The tips may also be substantially frayed or flagged. The surfaces further are usually covered with or formed of overlapping plates or scales, which retain paint or other coating material when the brush is dipped therein with a minimum tendency of the paint to spatter or run back down the handle when the brush is tipped upwardly. Since the bristles are substantially round in section, they also have approximately similar brushing characteristics in all directions.

As a result of world-wide conditions, bristles of high grade are now very difficult, if not impossible, to obtain and even under normal conditions, the supply and prices thereof are subject to wide fluctuations. Accordingly, it has been proposed to form bristles suitable for paint brushes or similar brushes by spinning filaments of a plastic material such as cellulose triacetate or nylon into long filaments or strands adapted to be cut up into lengths appropriate for assembly as bristles in brushes.

Much difficulty has been experienced in thus obtaining synthetic bristles which sufficiently approximate the natural products in all of their properties. Particular difficulty is experienced in obtaining a bristle which will retain an adequate quantity of paint or other coating material when a brush embodying the bristles is dipped therein and which after the brush has been charged, is not subject to excessive tendency to spatter or run. In order to improve the paint retaining characteristics of the bristles, it has been proposed to roughen the surface, especially the tip portions, by contacting the bristles either before or after assembly into brushes with an abrasive wheel or other buffing agency. Such operations obviously require considerable labor and are comparatively expensive. Also, it is relatively difficult by buffing to obtain adequate contact of the buffing agency with the bristles disposed in the center of the brush.

In my copending application Serial No. 524,666 of March 2, 1944, now Patent No. 2,443,055, entitled Brushes embodying synthetic bristles, it is proposed to form tapered bristles of dumbbell or kidney section. These bristles are designed to leaf together and provide capillary channels of exceptional paint retaining capacity in the brushes. Brushes embodying such bristles are a great improvement over prior types. However, it will be apparent that when a bristle whose width greatly exceeds its thickness is brushed over a surface in a direction parallel to its width, there is a tendency for it to twist or turn about

3

a longitudinal axis. This may break or disturb the capillary effects, thus promoting irregular flow or even spattering of the paint.

In accordance with the present invention, it is proposed to provide brushes of even better brushing characteristics by forming them of bristles, the butt portions of which are of kidney or dumbbell section designed to retain a large amount of paint, and the tips of which are so shaped as to present sections in which the ratio of width to thickness is practically unity. These bristles brush much more nearly uniformly in all directions than bristles which are kidney or dumbbell shaped throughout their length.

The conditions of operation as disclosed in this copending application may be employed in the preparation of bristles of varying sections in accordance with the provisions of the present invention.

A convenient method of forming the improved bristles involves spinning them in the manner described in my prior application or in Haux application, Serial Number 538,278, filed June 1, 1944, and entitled Synthetic brush bristle, now abandoned. However, in order to obtain bristles having lobate tips of substantially equal thickness and width and butts of greater width than thickness in accordance with the provisions of this invention, a spinner plate having lobate, e. g. trefoil, openings is employed. A pulsating pressure is employed to spin the bristle thread or filament at approximately constant speed. The filament is thus formed with alternate constricted and enlarged portions corresponding to the tips and butts of the bristles.

Surprisingly, it is found that when the bristles are spun through plates having openings of such contour and the solvent removed, the tip portions assume contours corresponding to the openings of the spinner plates, while the butt portions become flattened out approximately to dumbbell or kidney sections closely resembling the sections of the bristles disclosed in my prior application above mentioned.

Each bristle, as shown in Figs. 3, 4 and 6, comprises a butt portion constituting approximately $\frac{1}{2}$ to $\frac{3}{4}$ the length of the bristle and being of a dumbbell or kidney shaped section, of a width 2 or 3 times as great as the thickness, approximately corresponding to the sections of the bristles as disclosed in my prior Patent No. 2,443,055 above alluded to. The section of this portion is illustrated as taken along the line III—III of Fig. 6 and the shape of a typical example is shown in Fig. 3. The tip portion of the bristle constitutes approximately $\frac{1}{4}$ to $\frac{1}{2}$ the total length and should be of a section in which the width and thickness taken in any direction transverse of the bristle are approximately equal. It is desired that the section will be lobate in order to provide narrow channels or grooves designed to feed the paint, varnish or the like liquids retained in the capillary tubes above. A convenient section may be trefoil such as that illustrated in Fig. 4 which is taken approximately upon the line IV—IV of Fig. 6.

The sectional area of the butts with respect to the tip will be about 1.75. However, there may be considerable variation. By regulation of the maximum and minimum in the pressure cycle, the desired ratio is obtained.

An apparatus for the spinning operation is shown in Fig. 2 and embodies a pulsating pump apparatus 9 for delivering a solution of cellulosic ester under pressure to a spinner head. The

4

pump may be of any form, for example that described in the patent applications of John J. Gregory, Serial Numbers 459,251, now Patent No. 2,374,744, and 459,252 filed September 22, 1942, now abandoned. Since this pump is not a part of the present invention, it is not described in detail. The pump is connected by conduits 10 to a source of solution of a plastic suitable for spinning, e. g. cellulose triacetate, and is connected by means of a suitable conduit 11 with the spinning head 12 disposed in a trough 13 containing a setting agency such as mineral spirits.

The spinning head 12 is provided with a plate 14 having a multiplicity of small spinner head openings therein. Preferably, these openings are of a section corresponding to that desired in the tip portions of the bristles. For example, they may be trefoil to provide a trefoil tip portion which is found to be of excellent brushing characteristics. Usually, there will be a large number of these openings varying within the range of about 200 to 400. In Fig. 7, a few of these openings are shown. Of course, it is impossible for practical reasons to illustrate the actual number or the actual size because of the smallness of the scale of the drawings. It is to be noted that each plate is, as shown in Fig. 8, cupped and is provided with a flange 15 for fastening to the spinning head.

The filaments after setting in the bath are collected into a bunch or cable and passed over a suitable pulley 16^a and then upwardly about a series of take-up rollers 17 which may be driven at a constant speed in order to maintain sufficient tautness in the reach of filaments in the setting bath. From the take-up rollers, the filaments pass to drying chamber 18 which may be of any convenient design. Here, heat is supplied to drive off all non-solvent and setting agent clinging to or absorbed in the body of the filament.

It is to be noted that the filaments as they are spun out are joined together in continuous length as they are received from the drying apparatus. Each filament comprises alternating thick portions 22 and restricted portions 23 corresponding respectively to the butts and the tips of the bristles which are cut from the filaments. These alternating thickened and constricted portions are produced by the pulsation of the pressure generated by the pump 9. In the drawings, no particular attempt has been made to represent the bristles and their actual thickness, since they obviously are too small in diameter for accurate representation in this manner. Probably, they will be of an average denier of 20 to 4000.

After drying, the filaments are passed about pulleys or drums 24 and 25 of a mechanism design to cut them into sections through their thickest portions in such manner that each section includes two lengths of bristles. A suitable mechanism for automatically performing the cutting operation is disclosed in the patent application of John J. Gregory, Serial No. 499,264, filed August 19, 1943, now Patent No. 2,356,841. The bristles are gathered in bunches of appropriate size and are then secured in any convenient manner—for example, by means of paper bands for transmission to the brush makers.

The bristles may be formed of cellulose diacetate, cellulose acetobutyrate or other plastics, which can be dissolved to provide fluid, spinnable solutions, but at the present time it is preferred to form them of cellulose triacetate from a solu-

5

tion of the type described in my above mentioned co-pending Patent No. 2,443,055. The solution of plastic may, for example, comprise a 20 percent solution, or thereabouts, of cellulose triacetate (60.8 percent acetyl) in a mixture comprising 90 percent methylene chloride and 10 percent ethyl or methyl alcohol. This solution, as it is spun from the spinnerettes, may be coagulated in a bath of hydrocarbon such as toluene, xylene or kerosene. Mixtures of two or three or more of the coagulants may be employed.

It is remarkable that in the spinning operation, the tip portions or restricted portions of the filaments retain the shape, though of course on a smaller scale, of the spinnerettes through which they are emitted. However, the butt portion of the bristles constituting from $\frac{1}{2}$ to $\frac{3}{4}$ of the total length in most cases assumes a kidney or dumbbell section such as that illustrated in Fig. 3 of the drawings, in which the ratio of the width to the thickness is approximately of the order of 1 to 2 or 1 to $3\frac{1}{2}$.

The assembly of the improved bristles into a brush such as that illustrated in Fig. 1 of the drawings may follow substantially any convenient procedure. The bristles may be collected together in bunches of assorted sizes in order to give any desired brush characteristics to the ultimate product. It is also apparent that the synthetic bristles, as thus obtained, may be admixed with any desired ratio of natural bristles, such as pig bristles, ox hair, horse hair or the like, which may be employed in the manufacture of bristles.

A convenient mode of preparing a brush as that represented in Fig. 1 of the drawings involves bunching the bristles together to form a brush portion of suitable size and outline, then inserting the butt portions of the bristles with spacer strips or bars in place in a conventional sheet metal ferrule. The assembly of bristles and spacer strips in the ferrule preferably are impregnated in rubber or other adhesive material in order to effect a bond. The cementing material can be cured by heat or other means in order to obtain thorough hardening with resulting complete bondings of the bristles and spacer elements. The butt portion of the handle is inserted in the upper end of the ferrule and for purposes of security, nails are driven through the ferrule end of the butt portion of the handle. Similar nails may also be driven into the butt portions of the bristles of the brush in order to provide greater security of the bristles in the handle.

It is to be understood that the dumbbell or kidney sectioned butts of the bristles tend to leaf together in the manner described in my copending application, so that the concave faces provide capillary tubes that readily take up and hold paint or varnish.

The forms of the invention herein shown and described are to be regarded merely as exemplary and it will be apparent to those skilled in the art that numerous modifications may be made therein without departure from the spirit of the invention or the scope of the appended claims.

I claim:

1. A brush bristle suitable for use in paint

6

brushes comprising a filament of bristle length and being formed of synthetic plastic and being tapered from butt to tip and having a butt portion of a width of 2 to $3\frac{1}{2}$ times the thickness and a lobate tip portion of approximately equal width and thickness.

2. A brush bristle suitable for use in paint brushes comprising a filament of bristle length and being formed of cellulose plastic and being tapered from butt to tip and having a butt portion of a width of 2 to $3\frac{1}{2}$ times the thickness and a lobate tip portion of approximately equal width and thickness.

3. A brush bristle suitable for use in paint brushes comprising a filament of bristle length and being formed of cellulose acetate and being tapered from butt to tip and having a butt portion of $\frac{1}{2}$ to $\frac{3}{4}$ the total length and of a width of 2 to $3\frac{1}{2}$ times the thickness and a lobate tip portion of approximately equal width and thickness.

4. A brush bristle suitable for use in paint brushes comprising a filament of bristle length and being formed of cellulose triacetate and being tapered from butt to tip and having a butt portion of $\frac{1}{2}$ to $\frac{3}{4}$ the total length and of a width of 2 to $3\frac{1}{2}$ times the thickness and a lobate tip portion of approximately equal width and thickness.

5. A brush comprising a handle and having a bristle portion secured thereto comprising bristles each of which consists of a filament of bristle length, said filament being formed of cellulose plastic and being tapered from butt to tip, the butt portion being channeled and of a width from 2 to $3\frac{1}{2}$ times the thickness, the tip portion being lobate and of approximately equal width and thickness.

6. A bristle suitable for use in forming paint brushes, said bristle being composed of synthetic plastic and being tapered from butt to tip, the butt portion being of a thickness of approximately $\frac{1}{3}$ the width, the tip portion being of trefoil section.

7. A paint brush having a brush portion comprising bristles of synthetic plastic, the bristles being tapered from butt to tip and having base portions of approximately kidney shape and tip portions of trefoil section.

JOSEPH J. REIS, JR.

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