Oct. 3, 1967 J. GROBERT 3,344,457

PAINTBRUSHES

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Fig. 1.

Fig. 2.

Fig. 3.

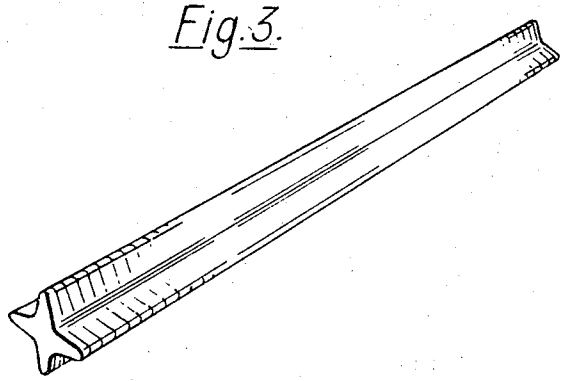

Fig. 4.

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PAINTBRUSHES

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ABSTRACT OF THE DISCLOSURE

The invention consists in new paintbrushes in which all or some of the bristles are synthetic, and which have particularly good properties, notably in respect of the amount of paint picked up and released, and especially of the area which can be covered after each pick up operation. The synthetic filaments are tapered and of cruciform cross-section; their thickest ends are held in the ferrule, and in any one plane perpendicular to the line of the bristles, each bristle has the same diameter. Polyamide bristles are preferred.

This invention relates to paintbrushes consisting at least partly of synthetic bristles.

Synthetic bristles, that is to say bristles of artificial or synthetic origin, have for some decades been more and more used in brushes, partly because of difficulties of supply of natural materials and an increase in the demand for brushware, and partly, especially in the field of paintbrushes, because of the low water absorption and the durability of these synthetic materials.

Attempts have been made to obtain articles whose properties resemble those of natural materials, especially as regards stiffness, and the pick-up, retention and release of liquids. For this purpose it was first of all suggested that the synthetic bristles should be crimped.

In order to produce products which are even closer to those which are manufactured from natural bristles, especially as regards progressive stiffness, it has been suggested to replace the normal cylindrical synthetic bristles partly or completely by bristles of the same type but of a truncated conical shape and of circular cross-section. These bristles, which have often been described by the term "tapered filaments," are generally manufactured by forming by extrusion, by various processes, filaments of alternately diverging and converging surfaces.

Bundles of the filaments so obtained, of different or identical maximum and minimum diameters and/or periodicity, are cut into short lengths at the points of maximum and minimum diameter, and thereafter one or more bundles of bristles so obtained are fixed to a handle by means of a collar or sleeve or other device. In practice, the ends of the short lengths of hair or bristle intended to form the free ends of the bristles are treated, before being fixed into the handle, either so as to tip them (increasing the conical nature of the thin end of the bristles) or so as to flag them (splitting this end into a number of small unequal branches). The majority of paintbrushes manufactured today from synthetic bristles are made from tapered bristles.

The present invention relates to a new paintbrush consisting at least partly of synthetic bristles, characterised by the said bristles being of essentially tapered shape and of essentially cruciform transverse section. Such cross-sections are readily obtainable by using spinneret orifices of suitable cross-section.

As a result of this combination of features, it is possible to manufacture paintbrushes which have characteristics which have been improved in a surprising manner. As will be seen in the course of the description, particularly in the examples, the paintbrushes of the invention have the advantages of the earlier paintbrushes of tapered bristles of circular section (paint pick-up, progressive stiffness, etc.) and also those of cylindrical cruciform bristles of longitudinal cylindrical section (improved stiffness). Furthermore they also have the unexpected inherent advantage of considerably improved pick-up and release of paint, and above all improved covering power. Moreover, the same level of other use characteristics can be obtained with a considerably lower weight of bristles than that needed with tapered bristles of circular cross-section. Finally, it has been observed that the tapered cruciform bristles can be tipped and flagged simultaneously, and this can be carried out directly on the filament carding machine, by contrast with the tapered bristles of circular cross-section, with which these two operations must be carried out separately if the same result is desired; furthermore, with the bristles of the invention this treatment is with advantage carried out on the assembled paintbrush.

In the present specification the term "cruciform" is to be understood in the sense that the transverse cross-section of the bristles has a central portion and three (T-shaped or Y-shaped cross) or four branches, or even more, the length and thickness of these branches being at least equal to the diameter of the central portion. It has for example been observed that bristles of non-circular cross-sections other than cruciform section, such as a multi-lobed cross-section or a trefoil cross-section, do not give the same remarkable results. In practice, especially good results have been obtained with bristles whose cross-section corresponds essentially to a Greek cross, to a potent cross or to variations thereon. The bristles of the invention may be produced from any linear organic polymer used for the manufacture of brush bristles. For example they may be made of synthetic materials such as polycondensates, including polyamides (of type 6, 6–6, 6–10, 6–12, 11, etc.) polyesters (polyethylene terephthalate), and polyurethanes; or of addition polymers, e.g. polyolefins (polyethylene, polypropylene) or polyvinyls (polyvinyl chloride) and their derivatives (polystyrene), and others. Of these the polyamides, and especially polyamide 6–10, are preferred.

The known methods may be used to incorporate the bristles in the paint brushes. A particularly advantageous process consists of cutting the bundles of alternating tapered cruciform filaments at the thickest and thinnest points, mixing the short lengths so obtained, setting them by means of glue into the ferrule of the paintbrush and finally tipping and/or flagging the free ends of the said bristles. Preferably the bristles are so arranged in the paintbrush that cross-sections of the same diameter lie in substantially the same plane perpendicular to the length of the bristles, the thick ends being fixed into the ferrule of the paintbrush, and the thin ends constituting the free ends.

Though generally the paintbrushes of the invention comprise only the tapered cruciform bristles, optionally of varying length and diameter, it is also possible for only a substantial part to be constituted in this way, the rest consisting for example of synthetic bristles of tapered or cylindrical form and circular or other non-cruciform cross-section, of various lengths and diameters, or of natural bristles etc., or of a mixture of any of these.

It has been found preferable that the minimum diameter of the bristles should be greater than 0.1 mm. and the maximum diameter below 0.5 mm.

In the illustrative examples the following determinations were made:

Stiffness (or pliability): this is the force in grams which has to be used to bend the brush over a given length measured by means of a pan balance.

Paint pick-up: this is the amount of an emulsion paint,

in grams, retained by the paintbrush every time it is immersed in the paint for a given time and over a given length.

Paint release: this is the amount of the emulsion paint, in grams, released by a paint brush onto a substrate after four to and fro movements, and is obtained as the difference between the paint pick-up and the paint retention (see below).

Paint retention: this is the amount of the emulsion paint not released by the paintbrush under the same conditions, and is obtained by weighing the brush before and after the four to and fro movements. (In an ideal paintbrush, the paint retention is substantially nil.)

Covered area: this is the area of a substrate which can be completely covered after each immersion of the paint brush and with a given number of to and fro movements; it is expressed in cm.^{2} and is determined by counting the number of 1 cm. squares of a graph paper which have been entirely filled.

The invention is further illustrated in the accompanying drawing, in which:

FIGURE 1 shows the approximate Greek cross cross-section of the bristles of paintbrushes B and E of Examples I and II respectively;

FIGURE 2 shows the approximate potent cross cross-section of the bristles of paintbrushes C and F of Examples I and II respectively;

FIGURE 3 is a schematic representation (not to scale) of part of a bristle illustrated in FIGURE 1; and

FIGURE 4 shows the trefoil cross-section of a known bristle, D of Example II.

Example I

Three flat paint brushes A, B and C were made having the following common characteristics:

Type of bristle: polyhexamethylene sebacamide (polyamide 6–10).

Length of bristles: 70 mm.

Conicity ratio of the bristles (ratio of the largest to the smallest diameter): approximately 1.8.

Maximum cross-section of the bristles (at the handle end): 0.043 mm^2.

Minimum cross-section of the bristles (at the free end): 0.014 mm^2.

Width of paintbrush: 50 mm.

Thickness of paintbrush: 15 mm.

In each paint brush the free ends of the bristles were carded to flag them.

Paintbrush A was made of tapered bristles of circular cross-section; paintbrush B of tapered bristles of cross-section essentially in the form of a Greek cross (FIGURE 1); paintbrush C of tapered bristles of cross-section essentially in the form of a potent cross (FIGURE 2).

The test results obtained with these paintbrushes are summarised in Table 1.

TABLE 1

Paintbrush	Weight of bristles used, in g.	Stiffness or force, in grams, to bend the paint brush over—			Paint pick-up in g.*	Paint release in g.*	Covered area in cm.^{2}**
		10 mm.	20 mm.	30 mm.			
A	19	190	280	425	4.0	3.0	205
B	16	250	335	560	4.5	3.25	275
C	16	205	280	420	5.0	4.0	260

*Measurement carried out when stable conditions have been reached, that is to say after 3 or 4 tests.
**Mean value of 5 tests.

This table shows the improvement achieved by the products of the invention. For a lower material weight, they have a greater paint pick-up and release than brushes made of tapered bristles of circular cross-section. Also, while at least as stiff if not stiffer, they have better performance in use. Finally, and most surprisingly, the paint brushes of the invention make it possible, under given conditions, to paint a considerably larger area than can be covered with the earlier paint brushes of tapered bristles of circular cross-section.

Example II

Three further flat paintbrushes D, E, and F were made, having the following common characteristics:

Type of bristle: polyhexamethylene sebacamide (polyamide 6–10).

Length of bristles: 95.25 mm.

Conicity ratio of the bristles: 1.8.

Maximum cross-section of the bristles (at the handle end): 0.083 mm^2.

Minimum cross-section of the bristles (at the free end): 0.025 mm^2.

Width of paint brush: 80 mm.

Thickness of paintbrush: 19 mm.

Length out of the ferrule: 88 mm.

The free ends of all the bristles had been treated to flag them.

Paintbrush D was made of tapered bristles of substantially trefoil cross-section. Such a brush is described in United States Patent No. 2,508,799 of Pittsburgh, Plate Glass Company, and the cross-section is illustrated in FIGURE 4 of the drawing.

Paintbrush E was made of tapered bristles whose cross-section is essentially in the form of a Greek cross (FIGURE 1), and paintbrush F of bristles whose cross-section is essentially in the form of a potent cross (FIGURE 2).

The test results obtained with these paintbrushes are summarised in Table 2.

TABLE 2

Paintbrush	Weight of bristles used in g.	Stiffness Coefficient *		Paint pick-up in g.	Paint release in g.	Covered area in cm.^{2}
		Wet	Dry			
D	82	0.32	0.29	8.0	5.1	198
E	55	0.29	0.29	10.0	6.3	420
F	71	0.38	0.37	9.1	6.4	405

*The stiffness coefficient is the figure in grams obtained by plotting the bending or flexion in mm. against the force in grams required to cause it, and drawing a tangent to the resulting curve through the origin, the point at which the tangent touches the curve giving the coefficient on the force axis.

For the same volume, the paintbrushes of the invention (E and F) contain a smaller weight of bristle and give paint pick-up and release figures better than those of brushes with tapered filaments of multi-lobal cross-section. Furthermore they enable a large area to be cov-

ered than was possible with the previously proposed paintbrushes. This was unexpected and unforeseen.

I claim:

1. A new paintbrush consisting at least partly of synthetic polymer bristles having an essentially tapered longitudinal cross-section and an essentially cruciform transverse cross-section, whose free end is flagged, said bristles being inserted into a ferrule at their point of greatest cross-section, and the cross-sections of the same diameter of the bristles of the same length being arranged essentially in the same plane.

2. A new paintbrush according to claim 1, in which at least part of the bristles are made of a polyamide.

3. A new paintbrush according to claim 1, in which the bristles are made of polyhexamethylene sebacamide.

4. A new paintbrush according to claim 1, in which the cross-section of the bristles is essentially in the shape of a Greek cross.

5. A new paintbrush according to claim 1, in which the cross-section of the bristles is essentially in the form of a potent cross.

6. A new paintbrush according to claim 1, in which the smallest diameter of the bristles is greater than 0.1 mm. and the largest diameter is less than 0.5 mm.

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