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(72) Inventor: **Nespoli, Alessandro**
6850 Mendrisio (CH)

(74) Representative: **Gassner, Wolfgang et al**
Dr. Gassner & Partner mbB
Patentanwälte
Marie-Curie-Strasse 1
91052 Erlangen (DE)

(71) Applicant: **Nespoli Group S.p.A.**
22060 Vighizzolo di Cantù (IT)

(54) **Paint brush**

(57) The invention relates of a paint brush, comprising:

a handle (1) having at its one end a bristle carrier (2),
and a plurality of bristles fastened to said bristle carrier (2) such that essentially all adjacent bristles are in contact with each other,
said plurality of said bristles comprising first bristles (4) having a first length L1 and second bristles (5) having a second length L2,
characterized in that
said first length L1 and said second length L2 satisfies the following relation:

$$L2 - L1 = d,$$

where d is a value between 4 and 18 mm, and
said first bristles (4) having a first stiffness being higher than a second stiffness of said second bristles (5).

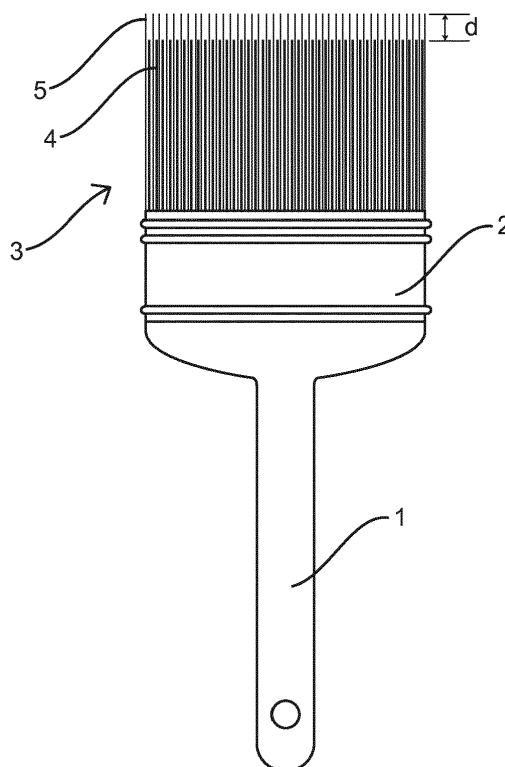


FIG. 3

Description

[0001] The present invention is directed to a paint brush in accordance with the preamble of claim 1.

[0002] In the prior art there are generally known paint brushes. Within the brushes there are distinguished paint brushes and brushes for cleaning purposes, e.g. tooth brushes and the like.

[0003] Brushes for cleaning purposes differ from paint brushes in that their bristles have a high stiffness making it possible to scratch away particles which adhere at a surface to be cleaned. In order to effectively discharge the removed particles the bristles are usually fixed at a bristle carrier such that a clearance is formed in between the bristles, e.g. the bristles are not in contact with each other. It is also possible that there are formed groups of bristles and that between the groups of the bristles there is formed the clearance for discharging the particles.

[0004] Paint brushes are usually made of bristles having a smaller stiffness than the bristles used for brushes for cleaning purposes. Essentially, all adjacent bristles of a paint brush are in contact with each other. The bristles form a bristle pack or brush head, respectively, which is able to hold therein a paint by adhesion as well as capillary forces. When painting the brush head is pressed onto the surface to be painted by the hand of the operator. Thereby, the bristles are bent and the paint being held between the bristles is forced to flow out of the brush head as it is moved along the surface to be painted.

[0005] Common paint brushes have a bristle head made of bristles having a length of 4 to 11 cm. The bristles are usually natural bristles, e.g. a root diameter in a root section of the bristles is typically between 0,17 and 0,35 mm, whereas a tip diameter in a tip section is in the range of 0,11 to 0,13 mm.

[0006] A paint brush in accordance with the preamble of claim 1 is known from US 5,220,702. The known paint brush is composed of a core of short thick hairs with long fine hairs surrounding said core and substantially longer stiff bristles dispersed throughout said core of thick hairs. The known paint brush is used to draw very fine lines. It has the capability to store a large amount of paint within the brush head.

[0007] US 2005/0229346 A1 discloses a paint brush having a brush head containing a continuum of bristles configured from a plurality of primary short bristles and secondary longer bristles with split and smaller diameter distal extremities.

[0008] Conventional paints having a high content of volatile organic components are recently more and more replaced due to legal restrictions by modern paints having just a small content of volatile organic components or even no volatile organic components. In practice it has turned out that a coating made of a modern paint and being applied by a conventional paint brush has a poorer surface quality than a coating made of a conventional paint. Reference is made to Fig. 1 which shows a schematically cross section through a first coating C1 made

of a conventional paint by use of a conventional paint brush and Fig. 2 showing a cross section through a second coating C2 made by a modern paint by use the same conventional paint brush. Reference sign S designates an substrate upon which the respective coating is provided.

[0009] It is a primary object of the present invention to overcome the problems in the art. According to a further object of the present invention there shall be provided a paint brush by which a coating made of a modern paint can be manufactured with a higher surface quality.

[0010] This object is solved by the features of claim 1. Embodiments of the invention result from the features of claim 2 to 9.

[0011] According to a first aspect of the invention a first length L1 and a second length L2 satisfies the following relation:

$$L2 - L1 = d,$$

where d is a value between 4 and 18 mm, and said first bristles having a first stiffness being higher than a second stiffness of the second bristles.

[0012] In the context of the present invention under the term "bristle" there is understood an elongated flexible body having just one first end and just one second end. The first end is part of a root section where the bristle is fastened in a bristle carrier. Said root section may have a length of 5 to 10 mm. Under the term "root diameter" there is understood an average diameter of the bristle in the root section. A second end of the bristle forms a free tip which usually contacts a surface to be coated with paint. The second end is part of the tip section of the bristle. The tip section has a length of 5 to 10 mm. Under the term "tip diameter" there is understood an average diameter of the bristle in the tip section.

[0013] Further, in the context of the present invention under the term "essentially all bristles" there is understood that at least 80%, preferably at least 90%, and most preferably at least 95% of the adjacent bristles are in direct contact with each other. According to a further aspect of the invention a plurality of bristles is fastened to said bristle carrier such that essentially all adjacent bristles are in contact with each other. I.e. the bristles form a pack or bristle head, respectively. The pack is a continuum where essentially all bristles are in contact. In particular, the first bristles surround at least partly the second bristles and thereby laterally support the second bristles in order to keep them upright. Within the pack formed of the first bristles having dispersed therein the second bristles, in at least in a tip section of the first bristles, there are no free intersections surrounding the bristles, i.e. essentially all adjacent bristles contact each other.

[0014] The "stiffness" or bending stiffness, respectively, can be measured e.g. with a bending stiffness meas-

urement apparatus which is e.g. provided by the company Lorentzen & Wettre GmbH. 10 pieces of bristles are measured in analogy to DIN 53121 which describes the determination of the bending stiffness measured in accordance with the beam method (see also ISO 2493). The bending stiffness is measured in centinewton (cN).

[0015] For this purpose a 50 mm long bristle is clamped in jaws of the measurement apparatus at a distance of 1,0 mm to a load sensor. The bristle is then bent up to an angle of 30° and again back to 0° while a maximum force is measured in cN.

[0016] The bending stiffness is calculated in accordance with the following formula:

$$B = F \times L/W,$$

wherein

B bending stiffness [N/mm²],
F bending strength at a bending angle of 30° [N],
L distance to the load sensor [mm], here 1,0 mm,
W modulus [mm³].

[0017] The modulus W is calculated using the following formula:

$$W = n \times D^3/32,$$

wherein D is the average diameter of the bristle [mm].

[0018] By the proposed paint brush it is advantageously possible to manufacture a coating with an excellent surface quality when using a modern paint having a small amount of volatile organic components or even no volatile organic components. Such modern paint is also called "low-VOC paint" and may be e.g. an acrylic paint, an acrylic lacquer, a water-based lacquer and the like.

[0019] According to an embodiment of the invention d is in the range of 5 to 15 mm, preferably in the range of 6 to 9 mm. The first bristles may have a first tip diameter in the range of 0,1 to 0,2 mm. The second bristles may have a second tip diameter in the range of 0,04 to 0,08 mm. The selection of the value for d as well as the relation of the first tip diameter to the second tip diameter result in a further improved surface quality of a coating being manufactured by the paint brush according to the present invention.

[0020] According to a further embodiment the first and the second bristles may be made of the same material. This allows a cheap and easy production of the paint brush. In this case the first and the second bristles have a uniform physico-chemical behavior with respect to the paint or a solvent.

[0021] According to a further embodiment of the inven-

tion the first and the second bristles may be made of a natural or a synthetic material. The natural material can be e.g. hog or goat bristles or bristles of other animal. The synthetic material may be selected from the following group: PE, PA, PET, PBT. The synthetic material may be mixture of the aforementioned materials.

[0022] The bristles may have a conical or cylindrical shape. In particular, bristles made of a synthetic material may have the following cross sections: solid, hollow, trilocular, quadrilocular. The material may be provided with small holes, the total volume of which may be in the range of 10 to 30 Vol.%. The tip section of the bristles may be treated mechanically or chemically. The tip section may be tipped or flagged.

[0023] According to a further embodiment a weight ratio between a first weight W1 of the first bristles and a second weight W2 of the second bristles may satisfy the following relation:

$$W1/W2 \leq 1.$$

[0024] Under the term "first weight W1" there is understood the total weight of all first bristles contained in the bristle head, and under the term "second weight W2" there is understood the total weight of all second bristles contained in the bristle head.

[0025] In particular, the weight ratio W1/W2 may be in the range of 0,4 to 0,8, preferably in the range of 0,5 to 0,7. E.g. the first weight W1 of all first bristles may be 30 to 50% of the total weight of the bristles. The second weight W2 of all second bristles may be 50 to 70% of the total weight of the bristles. It has turned out that by a paint brush having first and second bristles in the aforementioned weight ratio there can be manufactured a coating with an excellent surface quality when using modern paints.

[0026] Further objects and advantages of the invention will become more apparent and more radially appreciated from the following detailed description, taken in conjunction with the accompanying drawings, of which:

Fig. 1 is a sectional view through a coating manufactured with a conventional paint and a conventional paint brush,

Fig. 2 is a sectional view of a coating manufactured with a modern paint and a conventional paint brush,

Fig. 3 is a side view of a paint brush in accordance with the present invention,

Fig. 4 is a sectional view through a part of the bristle head according to Fig. 3 and

Fig. 5 is a top plan view upon a further paint brush.

[0027] The preferred embodiments of the paint brush of the present invention will hereinafter be described in detail with reference to the accompanying drawings.

[0028] Figs. 3 to 5 are views of paint brushes in accordance with the present invention. The paint brush is of "T"-form. It incorporates a handle 1 with as bristle carrier e.g. a ferrule 2 attached to one end of the handle 1 and a brush head 3 secured in the ferrule 2. Paint brush handles 1, ferrules 2 and methods of securing the paint brush head 3 in the ferrule 2 are known in the art.

[0029] The brush head 3 is composed of first bristles 4 and second bristles 5. As can be seen in particular from Fig. 4 the first bristles 4 have a first length L1 and the second bristles 5 have a second length L2. RS indicates a root section of the bristles 4, 5. The root section RS comprises the end section of the bristles 4, 5 which is fixed by the ferrule 2 and a glue 2a at the handle 1. Reference sign TS1 indicates a first tip section of the first bristles 4, and reference sign TS2 indicates a second tip section of the second bristles 5. A first tip diameter of the first bristles 4, being an average diameter in the first tip section TS1, may be in the range of 0,1 to 0,2 mm. A second tip diameter of the second bristles 5, being an average diameter in the second tip section TS2, may be in the range of 0,06 to 0,08 mm.

[0030] As can be seen from Figs. 3 and 4 a second length L2 of the second bristles 5 is greater than a first length L1 of the first bristles 4. The difference $d = L2 - L1$ is advantageously in the range of 6 to 9 mm.

[0031] As can be seen in particular from Fig. 4 the second bristles 5 are in contact along an essential part of their second length L2 with the first bristles 4. The first bristles 4 having a higher stiffness and a greater diameter than the second bristles 5 laterally support the first bristles 5 and keep them in an essentially upright position. The second bristles 5 can be dispersed uniformly within a pack formed by the first bristles 4.

[0032] According to a further embodiment - shown in Fig. 5 - it may also be possible that a pack being formed of first 4 and second bristles 5 forms a core 6 which is surrounded by a wrap 7 consisting just of first bristles 4.

[0033] A weight ratio in the mixture of first 4 and second bristles 5 is preferably in the range of 0,5 to 0,7. I.e. a first weight W1 of the first bristles 4 is preferably in the range of 35 to 45 wt%. A second weight W2 of the second bristles 5 is preferably in the range of 55 to 65 wt%.

[0034] While only a few exemplary embodiments of this invention have been described in detail those skilled in the art will radially appreciate that many modifications are possible in the preferred embodiments without materially departing from the teachings and advantages of the present invention. Accordingly, all such variations and modifications are intended to be within the spirit and the valid scope of the invention as defined by the following claims.

List of reference signs

[0035]

5	1	handle
	2	ferrule
	2a	glue
	3	brush head
	4	first bristle
10	5	second bristle
	6	core
	7	wrap
	C1	first coating
	C2	second coating
15	L1	first length
	L2	second length
	RS	root section
	S	substrate
20	TS1	first tip section
	TS2	second tip section
	W1	first weight
	W2	second weight

Claims

1. A paint brush, comprising:

- 30 a handle (1) having at its one end a bristle carrier (2),
 35 and a plurality of bristles fastened to said bristle carrier (2) such that essentially all adjacent bristles are in contact with each other,
 said plurality of said bristles comprising first bristles (4) having a first length L1 and second bristles (5) having a second length L2,
characterized in that
 said first length L1 and said second length L2 satisfies the following relation:

$$L2 - L1 = d,$$

- 45 where d is a value between 4 and 18 mm, and
 said first bristles (4) having a first stiffness being higher than a second stiffness of said second bristles (5).
- 50 2. The paint brush according to claim, wherein d is in the range of 5 to 15 mm, preferably in the range of 6 to 9 mm.
- 55 3. The paint brush according to one of the previous claims, wherein said first bristles having a first tip diameter in the range 0,1 to 0,2 mm, said second bristles having a second tip diameter in the range of

0,04 to 0,08 mm.

4. The paint brush according to one of the previous claims, wherein said first (4) and said second bristles (5) are made of the same material. 5
5. The paint brush according to one of the previous claims, wherein said first (4) and said second bristles (5) are made of a natural or a synthetic material. 10
6. The paint brush according to one of the previous claims, wherein said synthetic material is selected from the following group: PE, PA, PET, PBT or a mixture thereof. 15
7. The paint brush according to one of the previous claims, wherein a weight ratio between a first weight W1 of said first bristles (4) and a second weight W2 of said second bristles (5) satisfies the following relation: 20

$$W1/W2 \leq 1.$$

8. The paint brush according to one of the previous claims, wherein $W1/W2$ is in the range of 0,4 to 0,8, preferably in the range of 0,5 to 0,7. 25
9. The paint brush according to one of the previous claims, wherein in a cross section through a pack formed of all bristles (4, 5) there is formed a core (6) comprising said second bristles (5) being dispersed within the first bristles (4), said core (6) being surrounded by a wrap (7) consisting of said first bristles (4). 30 35

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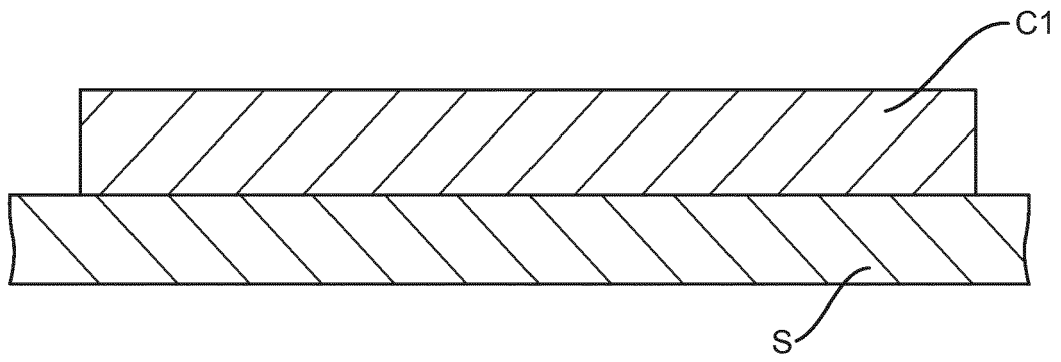


FIG. 1

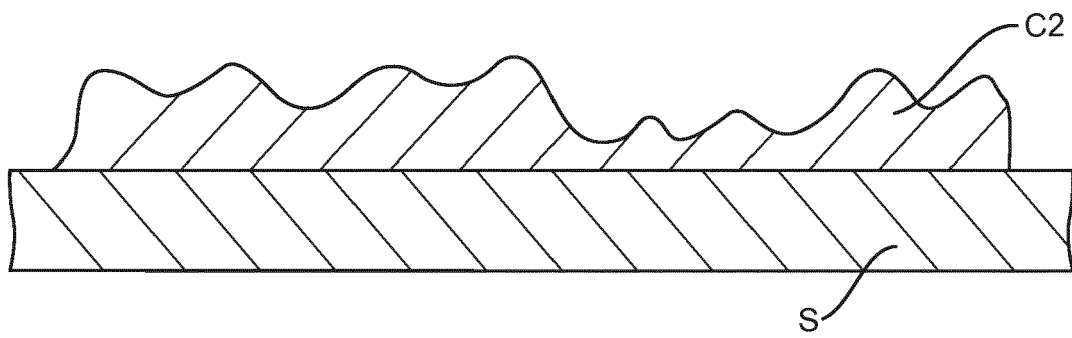


FIG. 2

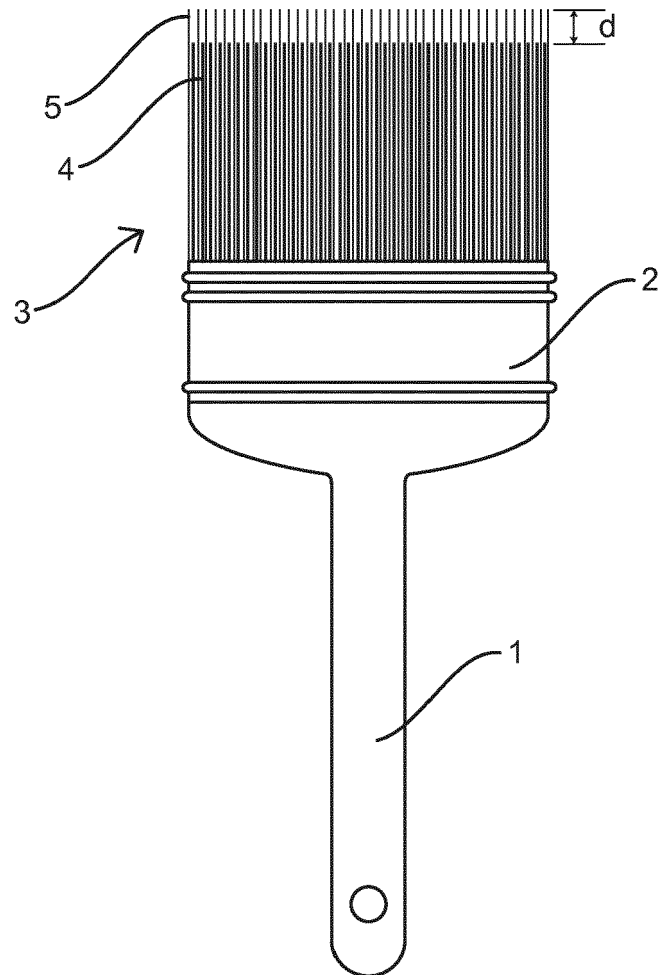


FIG. 3

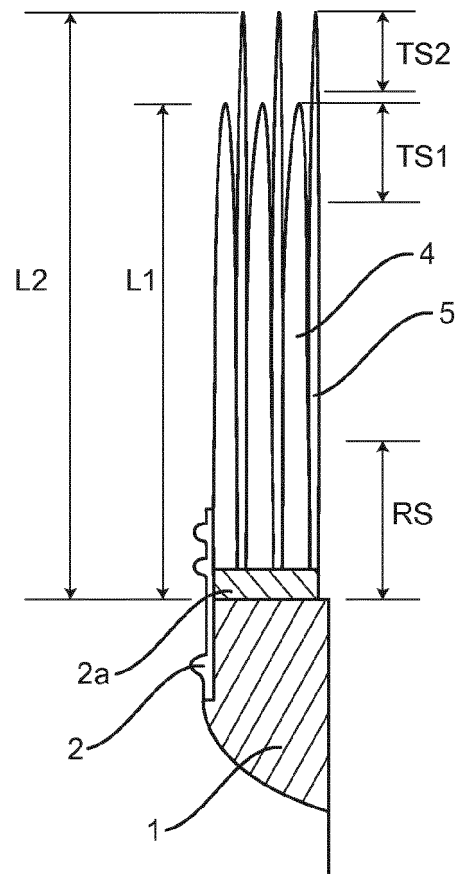


FIG. 4

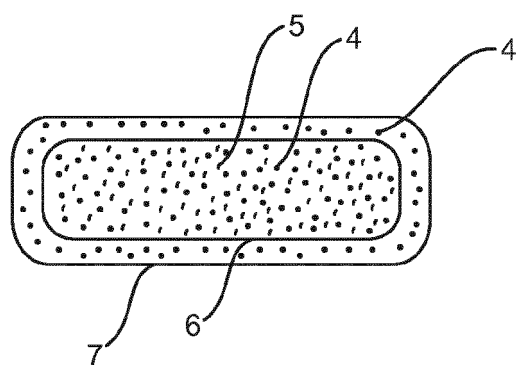


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 14 19 4160

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/034156 A1 (L G HARRIS & CO LTD [GB]; HOBBS STUART [GB]) 29 March 2007 (2007-03-29)	1,2,4-6	INV. A46B9/02 A46D1/00 A46B3/12
Y	* page 5, lines 21-24; claims 1-10; figures 1B, 1C, 3C, 4 *	3,7-9	
Y	DE 10 2012 105477 A1 (GEN ELECTRIC [US]) 27 December 2012 (2012-12-27)	3,7-9	
A	* paragraphs [0036] - [0051]; claim 6 *	1,2,4-6	
			TECHNICAL FIELDS SEARCHED (IPC)
			A46B A46D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 May 2015	Examiner Dal Bó, Paolo
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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