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CONSTRUCTION OF BRUSH FERRULE

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Fig. 1

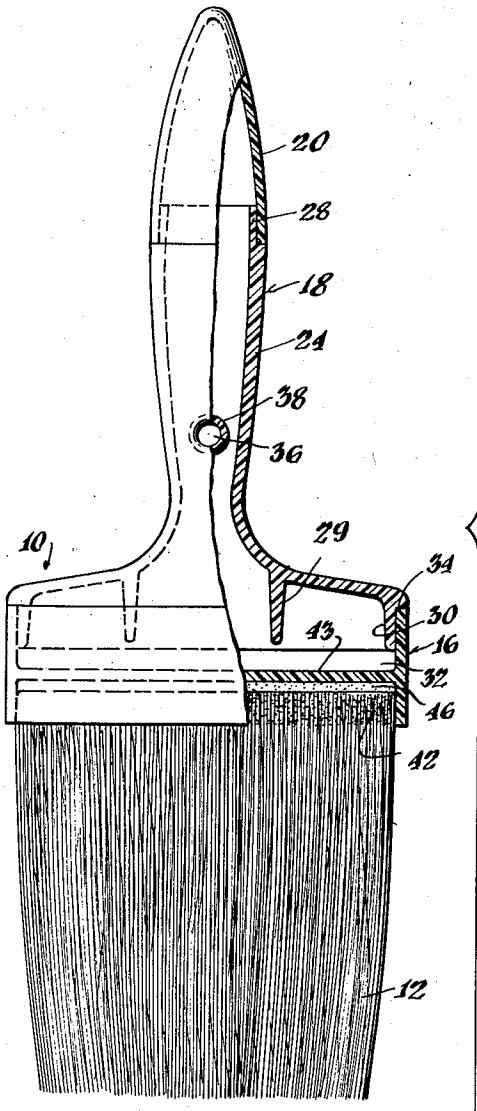


Fig. 2

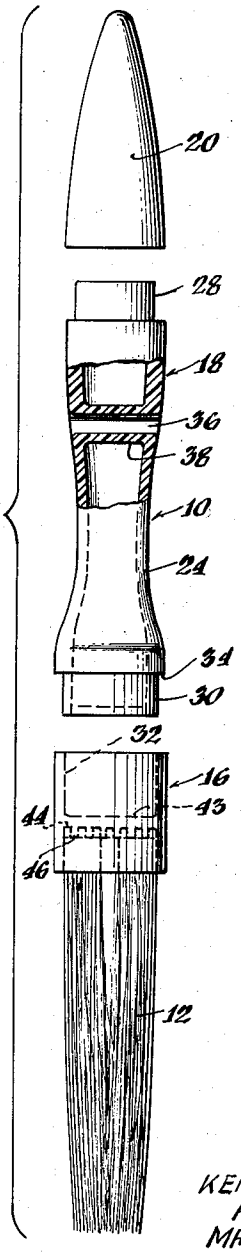


Fig. 3

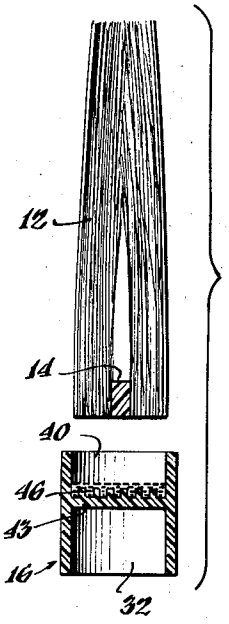


Fig. 4

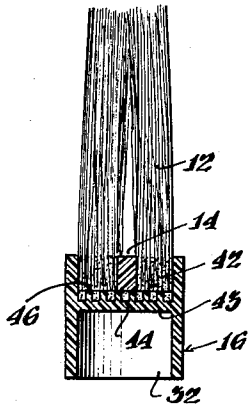
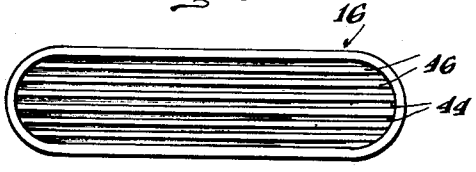


Fig. 5



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CONSTRUCTION OF BRUSH FERRULE

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4 Claims. (Cl. 15—193)

This invention relates to an improvement in the manufacture of brushes and in particular to an improved construction for paint brushes of the type in which the bristle knot and ferrule are bonded together into an integral structure.

The type of brush to which this invention relates is described in our copending application Serial No. 466,718 filed November 4, 1954. As there described, the bristles of the brush are anchored in a plastic ferrule by means of a cement which has solvent action on the ferrule so that the plastic material of the ferrule is plasticized, softened or dissolved in part by the cement and thereby united and made an integral part thereof. By amalgamating the bristle knot and ferrule together in this way the assembly has high resistance to the solvent action of paints and paint solvents and great structural strength is achieved which materially prolongs the life of the brush.

In our copending case we disclose an improved type of plastic ferrule especially adapted for use with our solvent cement. The ferrule is divided into two chambers by means of a partition. One chamber is adapted to receive the handle for the brush and the other chamber holds the butt end of the bristle pack. With this type ferrule the bristle pack is anchored in place by pushing the bristle butts down into a pool of solvent cement in the bottom of the chamber. We have now found that improved results may be had if the surface of the partition at the bottom of such chamber is provided with upstanding ribs or serrations. When this is done the butt end of the bristle pack is inserted down to the top surface of the ribs and the pool of solvent cement is held in the grooves of the serrations. As a result the solvent cement is gradually drawn up by the wicking action of the bristles and distribution of the cement throughout the resulting bristle knot is much more even and uniform.

Our invention is best understood by reference to the accompanying drawings in which—

Fig. 1 is a front view of the brush of our invention cut away in part to illustrate its construction;

Fig. 2 is a side view of the brush of Fig. 1 with the handle and ferrule separated;

Fig. 3 is a sectional view of the ferrule of Fig. 2 with solvent cement therein ready to receive the butt end of a pack of bristles. In this figure the ferrule of Fig. 1 is turned upside down;

Fig. 4 is a sectional view of the bristle pack and ferrule assembly; and

Fig. 5 is a bottom view looking up in to the ferrule of Fig. 1.

Referring now to the drawings, brush **10** is made up of bristles **12**, spacer strip **14**, a ferrule **16** and handle **18**. As shown in the drawings handle **18** is preferably made hollow and it is divided into two sections, a top section **20** and a bottom section **24**. The top section **20** is adapted to receive a tongue **28** of bottom section **24**. The lower portion of bottom section **24** of the handle is provided with a pair of reinforcing ribs **29** that extend

across between the two side walls of the lower portion of the handle. Bottom section **24** is also provided with a tongue **30** which is adapted to fit snugly into the top chamber **32** of ferrule **16**. Tongue **30** projects down below a shoulder **34** positioned on the exterior of the bottom section and shoulder **34** is approximately as wide as the thickness of the wall of top chamber **32** of the ferrule. The top of the wall of chamber **32** is positioned against shoulder **34** and this assists in anchoring the handle in place in the ferrule and it guards against the handle wabbling in use. Bottom section **24** of handle **18** also includes an opening **36** which is sealed off from the interior of the hollow handle by means of a collar **38** which is preferably made an integral part of handle **18**. Opening **36** provides convenient means for hanging the brush up to dry, or for suspending the brush in a can, without the weight bending the bristles.

Ferrule **16** includes a top chamber **32** for the handle and a bottom chamber **40** adapted to receive the butt end of a bristle pack **42**. The chambers are separated by means of a partition **43** and as most clearly shown in Figs. 2 and 3 in cross section ferrule **16** is in the general form of an H and the top and bottom chambers are preferably made approximately the same size so that the bearing surface for the handle in the ferrule is coextensive with the bearing surface of the ferrule against the bristle pack. As a result side pressure of the handle against the H ferrule is evenly distributed across the surface of the bristle pack and this so reduces the pressure per unit of area that we are able to make the wall of the ferrule thin without danger of its splitting open when the brush is in use. Further, the side walls of the bottom chamber **40** is of uniform thickness and the interior surface of the wall is smooth and even throughout without undulations, which is important since the bristles can then be uniformly distributed in the ferrule and paint is thereby evenly distributed on the work surface. Ferrule **16** need not be a four sided rectangle as shown in the drawings and it may be for example, circular or oval. The H ferrule is especially adapted for use with solvent cements that cure at room temperatures and atmospheric pressures. In general these cements are of low viscosity and it is difficult to control penetration of the cement down through the bristle knot by gravity flow and as frequently happens with an ordinary type of ferrule the cement flows down below the bottom of the ferrule leaving icicles which tie clumps of bristle together. When this occurs the brush is not a commercial item and must be discarded. On the other hand an H ferrule eliminates this problem since a measured quantity of our solvent cement is poured into chamber **40** (see Fig. 3) and the quantity of cement employed may be predetermined for the desired penetration of cement into the bristle pack. As shown in our copending case the surface of partition **43** is smooth but we have found that improved results are had if the surface of the partition is provided with serrations as shown in the drawings. When this is done the pool of solvent cement is held in grooves **44** which serve as a reservoir and ribs **46** prevent the bristles from penetrating down into the grooves so that the cement is gradually and more uniformly distributed throughout the bristle knot by the wicking action of the bristles. It will be understood that partition **43** need not be flat and if desired the partition may be convex to give a curved surface. In such case the bristle butts will follow the curve giving a so called cup chisel effect. It will also be understood that ribs **46** may be positioned diagonally across the surface of partition **43** and if desired the ribs may be made discontinuous to increase the amount of cement in the pool of the grooves.

The type of cement we employ for anchoring the

bristles in our brush is highly important and the cement must be one that is a solvent for the plastic material of the ferrule. By "solvent" we mean that the plastic material of the ferrule must be plasticized, softened or dissolved in part by the solvent cement to the extent that the cement and plastic material become united into an integral structure. For example, after the bristle knot has been formed and set in the ferrule there should be no sharply defined interface between the cement of the bristle knot and ferrule and the interface is either replaced by a solid solution of variable composition, a new chemical composition, or by a composition formed by uniting or amalgamating the solid materials as in those cases where a solvent cement is vaporized during heat treatment of the assembly. Some examples of solvent cements that we have used are meta- or para cresol, mono tertiary butyl cresol, phenols such as orthophenyl phenol, dihydroxy benzene polyphenols such as resorcinol, and any of the isomeric xylenols. We have achieved excellent results with the cold setting phenols, resorcinols, and phenoaldehyde resinous materials which may be cured at room temperature with the usual commercial curing agents. These solvent cements may be used alone or mixed with one another. Plastic material may be mixed with our solvent cement. Other high boiling point solvent cements selected in accordance with the known solubilities of the plastic material of the ferrule may be employed. For example, the solvent cement may be a high boiling point ortho hydroxy diphenyl in conjunction with a nylon ferrule, or in the case of an acetate ferrule cyclohexanone.

As to materials, the bristles, spacer strips, ferrule and handle may be made of thermosetting or thermoplastic materials. But it is an essential feature of our invention to select a plastic material for the ferrule which responds to the solvent action of the cement so that the surface of the ferrule becomes plasticized, softened or dissolved to the extent that it unites with the cement of the bristle knot to form an integral structure. Some examples of thermosetting and thermoplastic materials which may be used are nylon, cellulose acetate, cellulose acetate butyrate, methyl methacrylate, polyvinyl or polyvinylidine chloride and low pressure laminating polyester resins.

As to the bristles, we prefer to use synthetic bristles made with a suitable thermoplastic material which responds to the solvent action of the cement so that the bristles, ferrule and handle may be united into one integral structure. In some cases, however, it may be desirable to use natural bristles such as horsehair, hog, china, protein and the like, and it will be understood that as long as the material in the ferrule responds to the solvent action of the cement, such natural bristles may be used without departing from our invention even though the bristles are unaffected by the solvent action of the cement. In such case, bonding of the bristles is limited to surface action of the ordinary adhesives, but the bristle knot is amalgamated to the ferrule by the solvent action of the cement. Unless otherwise specified the word bristle when used elsewhere in this application is intended to include natural bristle as well as the synthetic thermoplastic bristles.

In general, we prefer to make the bristles, spacer strips, ferrule and handle all of the same plastic material, but this is not necessary, and different plastic materials may be selected for each element. In those cases where heat treatment is used to set the bristles, then the temperature coefficient of shrinkage of the ferrule should be at least equal to that of the plastic of the bristles, and if the handle is subjected to any appreciable amount of heat in the assembly, its temperature coefficient of shrinkage should be approximately equal to that of the ferrule.

If the cement is one that sets at room temperature or if the parts are not subjected to any appreciable amount of heat, then the shrinkage characteristics of the materials are not critical and the ferrule need only be made to fit snugly around the bristle knot and the handle and to fit snugly into the ferrule. Of course, contemplated use of the brush will dictate the type of plastic material which should be selected. For a paint brush, the bristles should be insoluble in paint oils and for a lacquer the bristles should be insoluble in the common lacquer solvents. Nylon and certain vinyl compounds, because of their resistance to organic solvents, find wide application in this field.

The following examples illustrate the manufacture of brushes made in accordance with our invention.

Example 1

A nylon bristle pack is weighed out and one or more nylon or if desired phenolic spacer strips are inserted in the bristle pack as shown in the drawings. The solvent cement which in this case is mono tertiary butyl cresol, is then poured into chamber 40 of a nylon ferrule. Enough solvent cement is used to wet all of the surfaces that are to be united including adjacent surfaces of the bristle butts, separator strips and the inside wall of the ferrule. Ordinarily we use just enough solvent cement to cover the tops of ribs 46 and for a four inch brush this requires about 3.0 cc. of solvent cement. The butt end of the bristle pack is then inserted into chamber 40 and this may be conveniently done by squeezing together the side walls of chamber 32 of the ferrule which causes the walls of bottom chamber 40 to slide into the chamber. The bristle pack slides down into the ferrule until the butt end of the bristle pack is positioned against ribs 46. The handle for the brush is then assembled and inserted into chamber 32 of the ferrule. In this case the handle is made of nylon and before inserting the handle into ferrule 16 the mating surfaces of the handle and ferrule are coated with solvent cement which in this case is mono tertiary butyl cresol. The assembled brush is then heat treated by holding it at a temperature of about 280° F. for about 40 minutes to remove excess cresol which evaporates from the assembly during heat treatment. After about 40 minutes the brush is cooled, care being taken not to bend or in any way damage the warm nylon bristles. When cool the spacer strip, ferrule and bristles were amalgamated into an integral structure. Brushes made as described show no separation of the ferrule from the bristle knot or separation of the bristles from each other even after use over a prolonged period of time. The temperature required for heat treatment is of course different for different solvent cements and is a matter of general knowledge in the resin art.

The following examples illustrate some possible combinations of plastic materials and solvent cements which we have used with excellent results. In each case the procedure followed in manufacturing the brush was described in the example given above with the exception that the heat treatment is eliminated for the cold setting cements which cure at room temperature.

Example 2

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Nylon	Nylon	m-Paracresol	275° F. for 7 to 40 minutes.

Example 3

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Nylon	Nylon	Cold setting resorcinol resin.	None.

Example 4

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Nylon	Nylon	Cold setting phenol-formaldehyde resin.	None.

Example 5

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Hog	Nylon	Cold setting resorcinol resin.	None.

Example 6

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Cellulose acetate.	Nylon	Meta cresol	275° F. for about 30 minutes.

Example 7

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Cellulose acetate.	Nylon	Cold setting resorcinol resin.	None.

Example 8

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Methyl methacrylate.	Methyl methacrylate.	Catalyzed [1] methyl methacrylate.	160° F. for about 4 hours.

Example 9

Bristles	Ferrule	Solvent cement	Temperature and time of heat treatment
Cellulose acetate.	Cellulose acetate.	Cyclohexanone	280° F. for about 40 minutes.

[1] The catalyst usually employed is benzoyl peroxide.

Referring to the examples the cold setting resorcinol resin is a commercial product readily available on the open market. It may be identified as a resorcin formaldehyde resin having insufficient aldehyde groups to cause the resin to set to an infusible insoluble state. The resin is made to set up at room temperature by adding a suitable catalyst containing either active methylene radicals or active methylol radicals such as are present in a 37% solution of formaldehyde. The resorcin formaldehyde resin and formaldehyde catalyst are mixed and then the mixture is poured into the ferrule. The resin sets in about six hours at room temperature. The phenol-formaldehyde resin referred to in the examples is a so-called B stage resin that may be catalyzed and cured at room temperature with phosphorus acid and like acid catalysts. Such solvent cement is also a well known commercial product sold on the open market. Satisfactory results have been achieved with a solvent cement of epoxy resinous materials that cure at room temperatures. In such case the ferrule is also made of an epoxy resinous material. Epoxy resins are, for example, formed by reacting together in known manner bis-phenol-A with an epoxy compound such as epichlorohydrin. The resulting liquid may be cured at room temperature with an amine such as diethylenetriamine. Referring now to the handle, where the handle is made of nylon plastic material an excellent solvent cement for uniting the two sections together may be conveniently formed with 80 parts of ordinary phenol and 20 parts of water. The mating surfaces of the handle are wet with the liquid and then fitted together. Ordinarily this solvent cement is not used on the bristle pack because it is too highly fluid.

The following example illustrates the use of natural bristles and thermosetting plastic materials for the ferrule wherein the ferrule and bristle knot are united into an integral structure by means of a cement having solvent action on the thermosetting materials.

Example 10

A bristle pack of hog bristles is weighed out and one or more spacer strips of glass fibers laminated with polyester resin are inserted into the pack. The ferrule in this case is made of several layers of glass fabric held together by means of a low pressure laminating polyester resin. The solvent cement in this case is the same polyester resin material used in the ferrule which is poured into chamber 40 of the ferrule. The amount of cement used is about 5.0 g. for the bristles in a 4 inch brush. The assembly is then set aside and held at room temperature until the cement is hard enough so that a plastic handle may be snapped in place in the ferrule without destroying the integral structure of the bristle knot ferrule assembly.

Polyester resins are readily available on the open market and the ones which are suitable for use in the manufacture of our brushes are known in the art as low pressure polyester laminating resins. These are characterized by the fact that they may be cured at room temperature and at ordinary atmospheric pressure. These polyesters are further characterized by the presence of unsaturated carbon bonds which undergo polymerization during cure without liberation of water. The resins are made of three groups of compounds: acids such as maleic, fumaric, itaconic and phthalic; alcohols and diethylene glycol; and unsaturated hydrocarbons such as styrene, cyclopentadiene, and similar compounds. The polyester is prepared by condensation of the acid and alcohol and it must contain at least one unsaturated alcohol or acid. The resulting unsaturated polyester is then capable of polymerizing upon cure to form cross linked three-dimensional structures. The polyester is mixed with an unsaturated hydrocarbon liquid such as styrene which acts as a solvent vehicle for the resin.

Upon the addition of a suitable peroxide catalyst, such as MEK peroxide and benzoyl peroxide with cobalt naphthanate as an activator, the resin is made to cure at ordinary room temperatures and pressures. For our purpose the polyester resin is thinned with styrene until it is fluid enough to give the desired penetration down into the bristle knot. Ordinarily 30 parts of styrene are used for 100 parts of the polyester resin. It will be understood that any of the polyester resins which set at ordinary room temperatures and pressures and which in liquid form are capable of exerting solvent action on the solid polyester material of the ferrule as described hereinabove, may be used as a solvent cement in the manufacture of our brushes. These polyester resins are sold on the open market under the trade names Laminac, Paraplex and Vibrin.

Example 11

The procedure of Example 10 was followed using the same materials and proportions but an epoxy resin and a cold setting epoxy resin solvent cement cured with an amine were used in place of the polyester resin and polyester solvent cement of Example 10.

One advantage of the construction of our brush is that metal parts such as nails, screws, rivets, and the like, which tend to rust or loosen up in use, are eliminated

from the structure of our brush, and although such nonmetallic handle and ferrule combinations have been previously suggested they are ordinarily made up in one piece. A one piece structure has its drawbacks, particularly in connection with the use of plastic materials. For example, a one piece plastic handle and ferrule combination is difficult to mold and the cost of molding such one piece unit makes the brush too expensive for practical commercial use. Secondly, if the one piece unit is made so that it will fit into the hand in the same way that conventional brushes do, it is so heavy that it is awkward to use. The one piece units also impose special problems in the bonding and setting of the bristles and this further increases the cost of such a brush. Accordingly, an important factor in the structure of our brush and one that has materially contributed to its commercial success is the fact that the handle and ferrule combination is made up of separate units that may be hollow and locked together without the use of metal parts. Another advantage is the two piece handle and ferrule combination which makes possible the use of different colored plastic materials which give a color break and materially improve the appearance of the brush. Further, individual color combinations may be established for designating brushes intended for use with a particular paint or paint solvent.

It will be understood that it is intended to cover all changes and modifications of the examples of our invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of our invention.

What we claim is:

1. A brush comprising a handle, a plastic ferrule and bristles packed at their butt ends within the ferrule, said ferrule having an imperforate partition therein which divides the ferrule into two chambers, said partition having serrations on the exposed surface of one side thereof, said ferrule and partition being a molded piece of unitary structure made of the same plastic material throughout and the bristles and ferrule of said brush being united together by means of a solvent cement which has solvent action on the plastic material of the ferrule whereby the cement of the bristle knot is united in an integral structure with the ferrule said serrations being adapted to form a plurality of grooves in the exposed surface of the partition which grooves provide a reservoir for the solvent cement so that a pool of cement may be positioned in the grooves on top of the partition and be subsequently drawn upwardly into the bristle pack by the wicking action thereof.

2. A ferrule for a paint brush having an imperforate partition therein which divides the ferrule into two separate chambers and said partition having serrations on the exposed surface of one side thereof said serrations being adapted to form a plurality of grooves in the exposed surface of the partition which provide a reservoir for the bristle cement so that a pool of cement may be positioned in the grooves on top of the partition and be subsequently drawn upwardly into a bristle pack by the wicking action thereof.

3. An all plastic paint brush comprising a plastic handle, plastic ferrule and plastic bristles packed at their butt ends within the ferrule, said ferrule having an imperforate partition therein which divides it into two separate chambers, said partition having serrations on the exposed surface of one side thereof said ferrule and partition being a molded piece of unitary structure made of the same plastic material throughout and the bristles and ferrule of said brush being united together by means of a solvent cement which has solvent action on the plastic material of the ferrule whereby the cement of the bristle knot is united to form an integral structure with the ferrule said serrations being adapted to form a plurality of grooves in the exposed surface of the partition which provide a reservoir for the bristle cement so that a pool of cement may be positioned in the grooves on top of the partition and be subsequently drawn upwardly into the bristle pack by the wicking action thereof.

4. A brush comprising a handle, a plastic ferrule and bristles packed at their butt ends within the ferrule and cemented therein, said ferrule having an imperforate partition which divides the ferrule into two separate chambers said ferrule and partition being a molded piece of unitary structure made of the same plastic material throughout, said partition having upstanding ribs positioned on the exposed surface of one side thereof with the upstanding ribs forming a plurality of grooves on the exposed surface of the partition which provide a reservoir for the bristle cement so that a pool of cement may be positioned in the grooves on top of the partition and be subsequently drawn upwardly into the bristle pack by the wicking action thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

2,508,931	Simms	May 23, 1950
2,648,861	Hardman	Aug. 18, 1953