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K. V. HARDMAN

2,406,732

BRISTLE SETTING

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Fig. 1

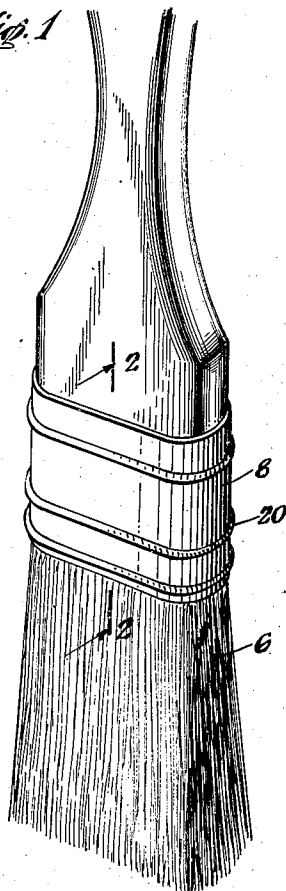


Fig. 2

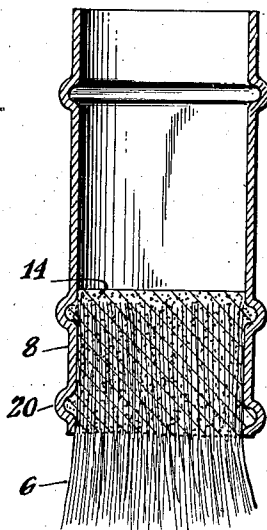


Fig. 3

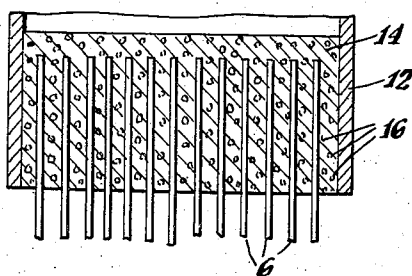
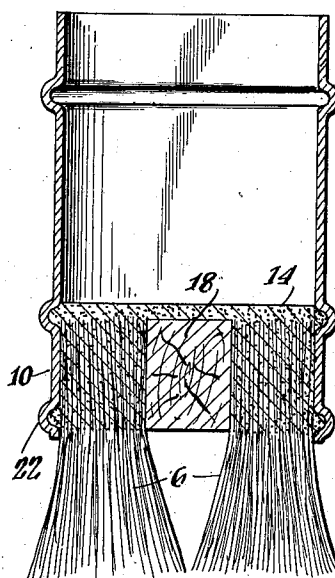
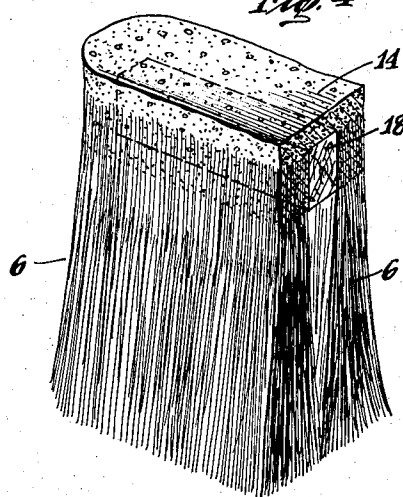


Fig. 5

Fig. 4



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BRISTLE SETTING

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5 Claims. (Cl. 300—21)

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This invention relates to bristle setting. It relates particularly to a method and setting in which the cement used is forced by pressure between adjacent bristle butts and between the assembled butts and the inside of the ferrule at the time the cement is being hardened, so that the cement quickly fills space left by the bristles as they shrink during the curing or early stages of cooling subsequent to curing.

It is common practice to insert the ends of an assembly of bristles within a ferrule of a brush and set the bristles in position by means of a cement that is hardened by heat. In this usual practice, the cement in flowable condition is suitably applied initially to the bristle butts by dipping them in a solution of the cement, the volatile solvent used in the solution then evaporated, and the cemented bristle butts then drawn into or otherwise fitted within the ferrule. In another common method, a cement is applied by pouring upon the bristle ends after they are in position within the ferrule.

In any case, the cement is hardened after application to the bristles. Common rubber cements are ordinarily used. They contain vulcanization material and the setting is effected by curing at elevated temperatures.

Animal bristles as used contain an amount of moisture that varies with the humidity to which they have been exposed and is ordinarily about 8%. During the curing some of this moisture is lost so that the bristles shrink substantially. Also the rubber cement which is used shrinks also in curing. These shrinkages result in undependable securing of the bristles in the cement or undependable cementing of the outside of the mass of cemented bristles within the ferrule.

The difficulty of properly securing the bristles within the ferrule and the avoidance of rejects is so great that the dipping method which otherwise would give the best setting, has been largely abandoned with round or rigid ferrules in favor of the pouring method which, while giving not as good setting, is less apt to lead to second quality or rejected brush settings because of the shrinkages referred to above.

Various expedients have been proposed to overcome the difficulty due to the imperfect setting of the bristles within the ferrule of brushes. Thus, it has been proposed to taper the ferrule

so that the setting after curing may be driven down and thus wedged within the narrower part of the ferrule.

Also, it has been proposed to cure the setting incompletely so that the shrinkage is decreased as compared to the shrinkage obtained on complete curing. This expedient, however, leads to a new disadvantage, namely, the greater susceptibility of the incompletely cured cement to attack by solvents.

Another corrective that has been used is the nailing or riveting of the set butt ends of the bristles within the ferrule.

Also bristles have been dried before setting so that they expand on exposure later to normal atmospheric humidity. This effect, however, has led in certain instances to deformation of the brush, the ferrule becoming more rounded as the bristles absorb moisture and expand.

The present invention provides means for overcoming these disadvantages and making a brush setting in which there is dependable satisfactory holding of the bristles.

Briefly stated, the invention comprises the product resulting from and the method of setting bristles within a ferrule or other holder with a heat hardenable cement that expands at the temperature of hardening, so that the cement is pressed into the spaces available to it, against the ends of the bristles assembled in the holder, and against the inside of the holder itself, all at the time the cement is undergoing hardening. In a preferred embodiment, the invention comprises such method and product in which the expanding cement used contains an elastomer of a butadiene copolymer and compounding ingredients including vulcanization material. The means preferred for causing the expansion of the cement is a blowing agent, that is, a compound that develops gas at the temperature of curing of the cementing compound.

The invention will be illustrated by description in connection with the drawing in which:

Fig. 1 is a perspective view of a brush in which the bristles are mounted in accordance with the present invention.

Fig. 2 is a vertical section on line 2—2 of Fig. 1.

Fig. 3 is a vertical section through a larger type of brush with wood insert member dividing the bristles into two spaced series.

Fig. 4 is a fragmentary perspective view of the bristle mounting of kind used in Fig. 3.

Fig. 5 is a diagrammatic view showing in more detail the relation of the bristles to the cement in the brush mounting.

The spacing of the bristles from each other and also the spacing of the gas bubbles in a number of the figures are exaggerated for clearness of illustration.

There are shown bristles 6 mounted in ferrules or holders 8, 10, or 12 by means of cement 14 which, in the finished set condition, includes bubbles 16 that are ordinarily either difficultly visible or microscopic in character but which are usually readily visible, as broken bubbles or cracks particularly, in the portion of the cement which extends above the mounted ends of the bristles as in Figs. 3 and 4.

In one modification the brushes may contain a usual type of wood spacing bar 18 which separates the assembly of bristles into two parts and increases the thickness of the brush for a given amount of bristles used.

The ferrules may contain beads, such as shown at 20 and 22, into which the cementing compound is forced by the expansion at the time of setting as shown for example in Figs. 2 and 3.

In general the technique of mounting the bristles within the ferrule or other holder is that ordinarily employed except for the inclusion of an expansion agent such as the blowing agent referred to.

The blowing agent must be one which develops gas in the cement composition at the temperature required to harden the cement. Thus there may be used diazoaminobenzene (Unicel), sodium bicarbonate, ammonium carbonate or carbamate. When a carbonate, carbamate or bicarbonate is used it is desirable to include in the cement compound a higher fatty acid. Such acid promotes the smooth and uniform gassing and expansion of the compound at curing temperatures.

Diazoaminobenzene is preferred as the blowing agent. It has a plasticizing effect upon the cementing compound used and gives greater internal pressure than other expansion agents listed when the whole assembly is cured.

The ferrule serves as a confining member to hold pressure upon the gassing cementing material and thus causes pressing of the cementing material against the bristle ends and between the said ends and the ferrule.

Any usual bristles may be used including those from hogs and horses, and synthetic bristles such as those made from nylon or cellulose acetate. When particularly smooth bristles such as those made from nylon are used, the ends that are to be mounted in the bristle setting are preferably sanded before being treated with the cementing material, as described in my copending application Serial No. 518,462, filed January 15, 1944, and entitled Bristle treatment.

As the heat hardenable binder in the cementing compound, there may be used rubber or a heat hardenable synthetic rubber, as, for example, one of the elastomers consisting of butadiene copolymers or polymerized chloroprene (neoprene). Phenolaldehyde condensation products also may be used. Particularly satisfactory results and a large increase in the strength and dependability of the mounting are obtained when the cementing material used is a compound containing an elastomeric butadiene copolymer with usual compounding ingredients and a blowing agent of the class described above, the copoly-

mers of butadiene with styrene known commercially as Buna S being particularly desirable. In place of this particular butadiene copolymer, there may be used to advantage also commercial copolymers of butadiene with other polymerizable monomers, say, Buna N, which is the copolymer of butadiene and acrylonitrile.

When the cementing material depends for hardening upon vulcanization of rubber or other elastomer present, as, for instance, one of the butadiene copolymers referred to, then the cementing compound should include compounding ingredients that are conventional in such elastomer compounds, including a vulcanization agent and suitably also a vulcanization accelerator. Thus sulfur may be used as the vulcanization agent in conjunction with any one of the common accelerators.

Also there is preferably used a plasticizer for the elastomer or the resin so that the compound until cured remains flowable although preferably viscous and semi-plastic. Examples of plasticizers that may be used include vulcanizable oils, aliphatic distillation pitches, coal tar resins, Bardol, vegetable oils or Naftolen 510.

Proportions of the conventional materials in the compound constituting the cement may be varied over rather wide proportions, to fit any particular hardness, rate of cure, or other property desired in the bristle setting, in a manner that will occur to one skilled in this art.

The blowing agent, on the other hand, must be used in proportion sufficient to overcome the normal shrinkage of the binder on curing and give the expansion necessary to cause the cement to expand to fill all spaces that should be filled by it and give good, pressed contact with the bristle butts and with the inside surface of the ferrule. Thus, there may be used to advantage 3 to 25 parts of diazoaminobenzene. For most purposes sufficient expansion and also economy of material are both realized when the proportion of the diazoaminobenzene is within the range 5 to 15% of the weight of the rubber component of the cementing compound. When the blowing agent used is sodium bicarbonate or ammonium carbonate or carbamate, larger proportions of these less effective materials are used as, for instance, up to 80 parts and preferably 40 to 80 parts for 100 parts of the Buna S or Buna N or other hardenable binder component.

The ingredients which go to make the cementing material are compounded in usual manner. Before application to the bristle ends to be mounted, the compound is ordinarily cut with a solvent to flowable viscosity. Thus, most of the cementing compounds may be and to advantage are dissolved in petroleum naphtha or the like. With certain other binders that are not soluble in petroleum hydrocarbons, there may be used selected solvents that are known to dissolve the special binders. Thus there may be used aromatic hydrocarbons, acetone, esters and the like, either alone or if necessary in mixtures with each other.

The invention will be further illustrated by description in connection with the following specific examples.

Example 1

In setting bristles with a dipping cement, there is made a compound containing Buna S as the elastomer and sulfur in amount adequate to give on curing a hard vulcanisate with the accelerators, plasticizers or other compounding ingredi-

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ents used. Thus there is compounded with a usual mixing machine the following materials in the proportions shown.

Ingredient:	Parts by weight
Buna S -----	100
Diazoaminobenzene (Unicel) -----	10
Sulfur -----	45
Benzothiazyl disulfide -----	.2
Diphenylguanidine -----	.8
Plasticizer (such as Naftolen #510) --	15

Dissolved in VM&P naphtha to dipping or pouring consistency.

The Naftolen referred to as plasticizer is an unsaturated hydrocarbon, covulcanizable with rubber and sulfur.

The upper ends of the bristles to be mounted are dipped into this solution of the cement. The solvent is then dried off at temperatures up to about 200° F. This leaves the cement compound in flowable but viscous condition surrounding the ends of the individual bristles.

The bristles with the cement thus applied around their ends are pulled into the ferrule, this step being known in the art as "sizing out."

This operation is promoted by the use of the plasticizer and also by the diazoaminobenzene which has a softening effect and increases the pliability of the Buna S ingredient of the compound.

The proportion of sulfur in the above formula may be varied as, for instance, from 30 to 60 parts for 100 parts of Buna S.

Other conventional plasticizers for Buna S may be used, although Naftolen No. 510 is particularly satisfactory for the present purposes. Among other plasticizers that may be used are high boiling coal tar fractions and resinous wood pitch.

Brushes which are set in the formula shown are heated to cure the cementing compound at 270° to 300° F.

The blowing agent used, namely, diazoaminobenzene, does not cause appreciable expansion of the compound at the temperatures used for drying out the solvent, as at temperatures up to 200° F. or so, but does liberate nitrogen gas causing expansion at the curing temperatures.

Since the compound is confined within the ferrule at the time of this gas liberation, the pores are fine and well distributed. Furthermore, the confinement by the ferrule causes the expansion to press the cement against the outer surfaces of the bristle ends and into the space between the bristle ends and the inside surface of the ferrule.

As a result of this internal pressure during the curing of the cement, the bristle setting has a solid continuously fluxed appearance on the ends of the bristles whether natural or synthetic.

Example 2

The procedure of Example 1 is followed except that the cement compound is poured over the upper ends of the bristles after they are poured into the ferrule. In this instance sufficient volatile solvent is left in the cement, at the time of pouring, to promote penetration of the cement a certain distance downward between the butt ends of the bristles.

Example 3

The procedure of Example 1 is followed except that there is used a compound including sodium

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bicarbonate as the blowing agent. Thus there is used as the cement a compound shown in the table below.

Ingredient:	Parts by weight
Buna N or Buna S -----	100
Tire sulfur -----	40
DPG -----	.5
Altax -----	.5
Sodium bicarbonate -----	50 to 80
Bardol -----	30 to 50

Dissolved in appropriate solvent such as toluene or VM&P.

At curing temperature the bicarbonate breaks down liberating carbon dioxide gas which develops the desired internal pressure.

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

What I claim is:

1. The method of setting bristles within a ferrule which comprises fitting within the ferrule the ends of the bristles composited with a heat hardenable, heat expansible cement in viscous but flowable condition, the cement being disposed between and outside the bristle ends, and then heating the assembly to the temperature of hardening and expansion of the cement so as to cause expansion and hardening of the cement, the cement as used containing a material that develops gas in the cement at the temperature of hardening of the cement.

2. The method of setting bristles within a ferrule which comprises fitting within the ferrule the ends of the bristles composited with a heat hardenable, heat expansible cement in viscous but flowable condition and then heating the assembly to the temperature of hardening and expansion of the cement, so as to cause expansion and hardening of the cement, the cement containing a butadiene copolymer as the binder and a blowing agent that develops gas at the temperature of hardening of the said copolymer and the ferrule confining the cement during the gassing and thus causing pressing contact of the cement with the bristle ends and with the inside surface of the ferrule at the time of hardening of the cement.

3. The method of setting bristles which comprises forming within a ferrule an assembly of the ends of the bristles with a heat hardenable, heat expansible cement in viscous but flowable condition, the cement being disposed between and outside the bristle ends, and then heating the assembly to the temperature of hardening of the cement so as to cause expansion and hardening of the cement, the cement being a compound including the elastomeric copolymer of butadiene and styrene, vulcanization material, and a blowing agent that in the cement develops gas at the temperature of hardening of the cement and the ferrule confining the cement during the development of gas.

4. The method described in claim 1, the material that develops the gas being diazoaminobenzene.

5. A brush setting comprising bristle ends fitted within a ferrule and a vesicular cement in hardened condition pressed firmly against the bristle ends and against the inside of the ferrule.

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