TWISTED STEM TUFTED BRUSH
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This invention relates as indicated to a twisted stem brush, and more particularly to one in which a plurality of individual separate tufts of brush bristle material are gripped and held by a twisted stem such that tufts projecting in different directions radially of the stem.

In my prior application Serial No. 553,317, filed December 15, 1955, now Patent No. 2,895,155, entitled "Wire Stem Brush," I disclose and claim a twisted stem brush having a flat tuft or layer of brush bristle material gripped and held between opposed stem wire lengths, such stem wire being of a particular configuration enhancing the grip of the same on the brush bristles as well as providing certain other advantages. In my prior co-pending application Serial No. 640,652, filed February 18, 1957, entitled "Brush Element and Belt Brush Construction," I disclose and claim a novel brush element comprising a plurality of individual tufts gripped and held by a wire stem member and projecting in the same direction, these brush elements being particularly suitable for mounting on endless belts or other like supporting means.

The present invention incorporates certain of the features of each of these prior inventions in a new manner to provide a different type of brush.

It is an object of my invention to provide a twisted stem tufted brush and method of manufacturing the same especially adapted for continuous automatic manufacture.

Another object is to provide a new brush and method of manufacture wherein the individual separate tufts may radiate in any desired directions from the central stem.

Still another object is to provide such brush in which each tuft may comprise a relatively long flat layer of brush material.

A further object is to provide a brush of the type indicated adapted to be mounted for rotation about the longitudinal axis of the stem.

Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:
Fig. 1 shows a novel tufted brush element suitable for use for some purposes but particularly adapted for further modification to form the brush of Fig. 3;
Fig. 2 is a transverse section taken on the line 2—2 on Fig. 1;
Fig. 3 is a transverse section similar to Fig. 2 but wherein the central stem members have been further twisted to provide two successive tufts longitudinally thereof so that the ends of such tufts define two helices, each tuft being somewhat circumferentially offset from the next adjacent tuft;
posed faces 11 generally comparable to the recess faces 6 of Figs. 4 and 5 but affording somewhat more gently rounded contours. The stem members may be of annealed, half-round cotter wire having a Rockwell hardness of "B30-50," for example. A ribbon of elastomeric material 13 is applied to each such groove or recessed surface 12, such ribbon being wide enough to extend between the most closely opposed side edge portions of stem members 10 and 11. The brush material gripped therebetween is accordingly secured in the same general manner as that in Fig. 5 but is also gripped and cushioned by the elastomeric material where it emerges from between the stem members, reducing vibratory concussion of stem 1 of the abutting longer brush life.

The elastic material 13 of Fig. 6, which may for example be rubber or Neoprene tape, will ordinarily be bonded to the wire stem members by an appropriate adhesive such as rubber cement.

The Fig. 7 embodiment is similar to that of Fig. 6 except that the wire stem members 10 and 11 are completely coated with elastomeric sheets 14 which may be extruded thereon or applied by means of a latex dip. Such elastomeric material may be compositions of natural rubber, Neoprene, butadiene-styrene copolymer, butadiene-acrylonitrile copolymer, vinyl chloride-vinyl acetate copolymer, and vinylidene chloride-vinyl chloride copolymer, or other well-known resiliently deformable material, as may be desired. Plastics such as nylon may also be preferred materials for this purpose. These same materials may also be deposited in the Fig. 5 grooves also.

When steel brush bristle material is employed, it may often be advantageous to employ steel wire having a relatively high Knoop hardness (at least 600 Knoop), Hadfield steel being a suitable example. When such bristle materials are employed, it is particularly desirable that they be gripped and held by cushioning materials such as those of Figs. 6 and 7. The individual bristle wires may also be coated with a thin vibration damping plastic coating such as nylon bonded thereto by means of an epoxy resin cement.

Referring now more especially to Fig. 3, it will be understood that the double tufted brush strip of Fig. 1 may be further twisted between each successive pair of tufts to offset successive tufts circumferentially of the central stem. In Fig. 3, it will be understood that tufts 4—4C represent such successive tufts originally aligned one side of the stem wire and that tufts 5—4C represent the corresponding diametrically opposed tufts formed of the same bundle of brush material. Obviously, the degree of progressive circumferential tuft offset may be selected as desired to suit the particular use intended, but ordinarily such offset may be selected to arrange the tufts in two diametrically opposite long lead helices. Brushes of this sort are adapted to be employed in floor and carpet sweepers and the like, for example, and it should be understood that the stem members may be of relatively sturdy cross-section and twisted together in a very precise manner to provide a central stem or support of little or no eccentricity.

The wire stem members or retaining elements 1 and 2 are placed on opposite sides of a continuous layer or band of the selected brush material, which band is confined as to width to which it might spread in the region of contact with such stem members, and heavy pressure is applied such layer therebetween. At a suitable time in the process of manufacture of the brush element, such layer or band of brush material is severed at the desired distance from the stem wires to produce a tuft of proper length, and the stem wires are twisted preferably 360° or some multiple thereof, the oppositely projecting tufts rotating during such operation. The pressure compacted tuft is thus tightly confined. At a suitable time in the process of manufacture, the brush material layer or band end which has been severed in forming a previous tuft is advanced and positioned between separated wires 1 and 2 adjacent the twisted portion of the stem wires and the previously positioned and clamped brush material tuft secured thereby, and the layer is again confined and subjected to heavy pressure while held between the stem wires pressed thereagainst, and severed to the desired tuft length prior to twisting thereof with rotation of all previously severed tufts together. Repetition of these operations may produce an elongated brush element comprising an alignment of spaced parallel tufts secured to a twisted wire stem or base. Rather than thus twisting the wires together, they may be otherwise joined as by spot welding intermediate the tufts.

When the brush is to be formed into the Fig. 3 embodiment of my invention, I will ordinarily first form the Fig. 1 embodiment as above described and then continuously progressively twist a predetermined length thereof 360° from end to end with consequent circumferential offset of successive tufts. Of course, the degree of twist may be varied as desired and such further twisting may be confined to the already twisted regions intermediate the successive tufts, thereby maintaining the individual tufts more in a plane including the stem. Alternatively, the initial twisting operations in the formation of the brush element may be performed to achieve such circumferential offset of the tufts instead of forming the Fig. 1 flat strip as an intermediate stage.

When compacting the flat layers of bristle material 3 between the wire stem members preparatory to securing such stem members together as by twisting, it will be desirable to apply very heavy pressure on the order of several thousand pounds per square inch (e.g. 10,000—20,000 pounds per square inch or more in the case of crimped wire brush material). The wire stem members will ordinarily be gripped by cushioning materials such as rubber, or other part of die members grip the stem portions embracing the layers of brush material to rotate the same as a unit. In addition to employing the brush elements of Figs. 1 and 3 for rotary sweeping purposes and the like, many other uses will be apparent. Thus, the tufted brush element of Fig. 1 may be secured within a channel base in the general manner disclosed in my prior patent 2,303,386 with the pairs of tufts extending outwardly from the channel side by side.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A new article of manufacture, a brush element comprising two wires secured together at longitudinally spaced intervals to form a stem, and brush material interposed at intervals transversely between said wires to form a series of spaced pairs of flat oppositely extending tufts, said stem wires being thus secured together only in the regions intermediate said pairs of tufts to clamp and space the latter, wherein the portions of said stem wires clamping said brush material are straight, successively pairs of oppositely extending flat tufts are thus clamped by said wires, and said stem wires are twisted in the intervening regions only circumferentially to offset successive flat tufts in helical fashion.

2. The method of manufacturing a brush element which comprises twisting together two generally half-round wire stem members with their convex surfaces outwardly disposed, placing a flat layer of brush bristle material transversely between such members to form a pair of oppositely extending tufts, compacting such layer forcibly between such stem members, twisting such stem members together closely beyond such layer to secure the same together, similarly placing another flat layer of brush bristle material between such stem members
immediately beyond the last twisted portion, compacting such latter layer forcibly between such stem members, and twisting such members together closely beyond such latter layer to secure the same together while permitting such previous layer and twisted stem portions to revolve with such latter twisting operation, such latter twisting operation being concluded with the tufts of such latter flat layer lying in the same plane as the tufts of the first mentioned flat layer but spaced therefrom by the intermediate twisted portion of such stem.

3. The method of claim 2, including the steps of further twisting such stem members intermediate said successive layers only to circumferentially offset successive tufts.

4. The method of claim 2, including the step of further twisting such stem members throughout their layer clamping length to circumferentially offset such successive tufts in general helical manner.

5. As a new article of manufacture, a brush element comprising two wires secured together at longitudinally spaced intervals to form a stem, and brush material interposed at spaced intervals transversely between said wires to form a series of pairs of flat oppositely extending tufts, said stem wires being thus secured together only in the regions intermediate said pairs of tufts to clamp and space the latter, and the faces of said stem wires engaging said brush material being of substantial width better to grip said material and maintain said tufts flat, wherein numerous successive layers of brush material are thus arranged and secured in longitudinally spaced regions along said stem, and said stem is twisted circumferentially to offset successive pairs of tufts.

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