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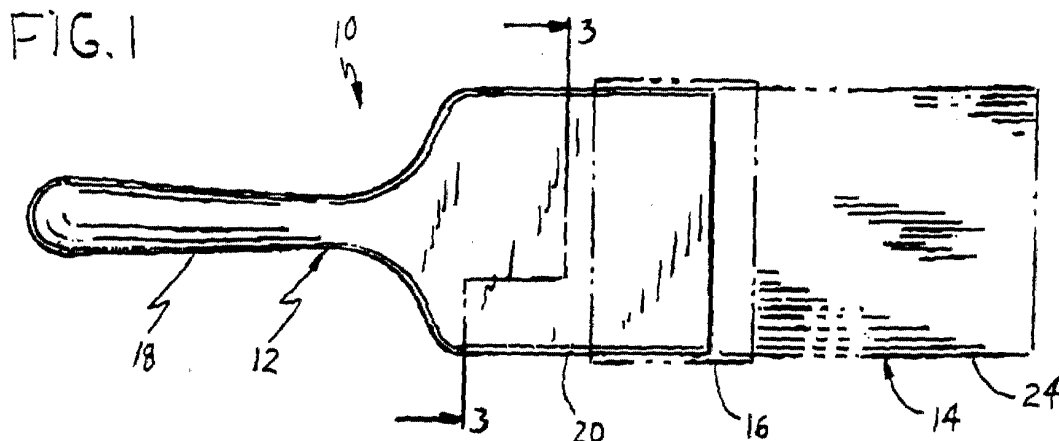
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(54) **Method for forming variable paint applicators**

(57) A method for forming a plurality of distinct paint applicators having a common exterior head configuration and distinct paint applying medium configurations includes forming a plurality of handles and forming a plurality of paint carrying units. Each handle formed includes a head having an exterior configuration and an interior having a mouth and head thickness between the exterior configuration and the mouth. Each paint carrying unit includes at least one paint applying medium cou-

pled to a mounting portion that is disposed within an interior of one of the plurality of handles. The mounting portion has a mounting portion exterior configuration and a mounting portion thickness between the mounting portion exterior configuration and the paint applying medium. To form the plurality of distinct paint applicators, the configuration of the paint applying medium is varied while at least one of the head thickness and the mounting portion thickness is also varied.



## Description

### CROSS REFERENCE TO RELATED APPLICATIONS

**[0001]** The present application claims priority under 35 U.S.C. § 119 from U.S. Provisional Patent Application Serial No. 60/196,513, entitled PAINT BRUSH AND METHODS OF MANUFACTURE filed on April 11, 2000, the full disclosure of which is hereby incorporated by reference. The present application is also related to co-pending U.S. Patent Application Serial No. \_\_\_\_\_, entitled ADJUSTABLE FERRULE PAINT BRUSH AND METHODS OF MANUFACTURE by Brian E. Woodnorth, Darryl L. Kaminski, and Kenneth R. Morris which was filed on the same date herewith, the full disclosure of which is hereby incorporated by reference.

### FIELD OF THE INVENTION

**[0002]** The present invention relates generally to the field of paint applicators and methods for manufacturing paint applicators.

### BACKGROUND OF THE INVENTION

**[0003]** Paint applicators, such as paint brushes, are used to apply paint, varnish, stains and other liquid coatings to surfaces. Conventional paint brushes typically include a handle, a group of bristles and a ferrule securing the group of bristles to the handle. The handle typically includes an elongate narrow diameter gripping portion or shank which widens at a shoulder to form a head. The handle is typically formed from either wood or a rigid plastic. Brush handles formed from rigid plastic are typically injection molded. As conventionally known, injection molding involves filling a cavity that is in the shape of the brush handle with a liquid plastic which is then allowed to solidify before the mold is separated from the finished handle. In some applications, a mold core is positioned inside the mold such that the injected plastic flows within the mold about the core. After the plastic has solidified, the core is removed and the mold is separated to leave a handle having a hollow interior. The resulting cored-out handle has an open axial end. In particular applications, the plastic brush handle is overlaid or co-molded with a soft and compressible plastic as set forth and described in co-pending U.S. Patent Application Serial No. 08/841,271, the full disclosure of which is hereby incorporated by reference.

**[0004]** The group of bristles typically comprises a plurality of individual brush filaments formed from hair or artificial fibers such as nylon. The filaments are generally interleaved with one or more wedges or spacers. The filaments as well as the spacers are secured to one another and are secured to the ferrule by an epoxy.

**[0005]** The ferrule typically comprises a thin band of metal partially overlapping the group of bristles and the

head of the brush handle, while securing the bristles to the handle. Typically, the ferrule is secured to the group of bristles by the aforementioned epoxy and is secured to the head of the brush handle by staples, rivets or other fasteners extending through the ferrule and into the head or by adhesives between the ferrule and the head.

**[0006]** Manufacture of such conventional brushes is generally as follows. First, the brush handle is formed as described above. Second, the brush filaments are bunched together and are pulled through the ring formed by the ferrule. Third, the spacers are inserted between the bristle filaments and then the spacers and adjacent bristle filaments are pulled into the ferrule whereby the spacers wedge the axial end of the filaments against the ferrule. Fourth, a relatively thin layer of liquid epoxy is deposited into the ferrule, bonding the bristle filaments and the spacers to the ferrule. Lastly, the ferrule is secured to the head of the brush handle as described above.

**[0007]** Although most paint brushes are formed by the above described process, the process and the resulting brush have several disadvantages. First, the solid brush handles formed by injection molding are time consuming to manufacture, require large amounts of material and are heavy. Coring out the head of the handle to produce a lighter handle increases complexity and time required to manufacture the handle and also results in a structurally weaker handle which, as a result, must be formed from stronger yet more expensive plastics. Moreover, because a uniquely sized and configured mold and possibly core is required for each differently sized paint brush handle and paint brush, manufacturing costs are further exacerbated.

### SUMMARY OF THE INVENTION

**[0008]** According to one embodiment of the present invention, a method for forming a plurality of distinct paint applicators having a common exterior head configuration and distinct paint applying medium configurations includes forming a plurality of handles and forming a plurality of paint carrying units. Each handle formed includes a head having an exterior configuration and an interior having a mouth and head thickness between the exterior configuration and the mouth. Each paint carrying unit includes at least one paint applying medium coupled to a mounting portion that is disposed within an interior of one of the plurality of handles. The mounting portion has a mounting portion exterior configuration and a mounting portion thickness between the mounting portion exterior configuration and the paint applying medium. To form the plurality of distinct paint applicators, the configuration of the paint applying medium is varied while also varying at least one of the head thickness and the mounting portion thickness. According to another embodiment of the present invention, a method for forming a plurality of distinct paint applicators having a common exterior head configuration and distinct paint ap-

plying medium configurations includes forming a plurality of handles and forming a plurality of paint carrying units. Each handle formed includes a head having an exterior configuration and an interior having a mouth and head thickness between the exterior configuration and the mouth. Each paint carrying unit includes at least one paint applying medium coupled to a mounting portion that is disposed within an interior of one of the plurality of handles. The mounting portion has a mounting portion exterior configuration and a mounting portion thickness between the mounting portion exterior configuration and the paint applying medium. To form the plurality of distinct paint applicators, the configuration of the paint applying medium is varied while also varying at least one of the head thickness and the mounting portion thickness.

**[0009]** According to another embodiment, a plurality of paint applicators includes a first applicator and a second applicator. The first applicator has a first handle having an exterior configuration that first paint applying medium coupled to the first handle and having a first medium configuration with a first width and a first thickness. The second applicator includes a second handle having the same exterior configuration in a second paint applying medium coupled to the second handle. The second paint applying medium has a second medium configuration having a second width and a second thickness different than the first width and the first thickness, respectively.

**[0010]** According to another embodiment, the plurality of paint applicators includes a first applicator and a second applicator. The first applicator includes a first handle having a first paint applying medium. The first handle has an exterior configuration and a first interior cavity having a first interior configuration. The first paint applying medium is coupled to the first handle and has a first medium configuration. The second applicator includes a second handle and a second paint applying medium. The second handle has the same exterior configuration and a second interior cavity having a second interior configuration different than the first interior configuration. The second paint applying medium is coupled to the second handle and has a second medium configuration different than the first medium configuration.

**[0011]** According to another embodiment, a plurality of paint applicators includes a first applicator and a second applicator. The first applicator includes a first handle and a first paint applying medium. The first handle has an exterior configuration. The first paint applying medium has a first configuration that is coupled to a first mounting portion having a first size dimension. The second applicator includes a second handle and a second paint applying medium. The second handle has the same exterior configuration. The second paint applying medium has a second configuration and is coupled to a second mounting portion. The second mounting portion has a second size dimension different from the first size dimension.

**[0012]** According to another embodiment, the paint applicator includes a handle, at least one paint applying medium and a mounting portion. The handle has an internal cavity including at least one projection. The mounting portion is coupled to the at least one paint applying medium and is received within the interior cavity. The at least one projection engages the mounting portion. The present invention may also comprise apparatus and methods according to the following descriptions:

**[0013]** Description 1: A paint applicator comprising: a paint applying medium; and a handle coupled to the paint applying medium, the handle comprising: a first portion; and a second portion coupled to the first portion along a junction, wherein the first and second portions extend opposite one another to form the handle; and an elastomeric layer sealing the junction between the first portion and the second portion.

**[0014]** Description 2: The applicator of description 1, wherein the elastomeric layer forms a seal over the junction.

**[0015]** Description 3: The applicator of description 1, wherein the elastomeric layer forms a seal between the junction.

**[0016]** Description 4: The applicator of description 1 including a hinge between the first portion and the second portion.

**[0017]** Description 5: The applicator of description 4, wherein the hinge is integrally formed as part of a single unitary body with the first portion and the second portion.

**[0018]** Description 6: A method for forming a paint applicator handle, the method comprising: providing a mold; positioning a preform into an interior of the mold, the preform having a head portion forming a cavity with a mouth and a shank portion; heating and expanding the shank portion against the mold; and removing the formed handle from the mold.

**[0019]** Description 7: A bristle cartridge comprising: a plurality of bristle filaments arranged into a cluster; at least one spacer within the cluster; and a polymeric material coupling the bristle filaments and the at least one spacer together, wherein the polymeric material forms a body configured to be received within a paint applicator handle.

**[0020]** Description 8: The cartridge of description 7, wherein the polymeric material includes a tie layer.

**[0021]** Description 9: A method for forming a paint applicator, the method comprising: providing a bristle cartridge including a plurality of bristle filaments arranged into a cluster; at least one spacer within the cluster and a polymeric material coupling the bristle filaments and the at least one spacer together; and encapsulating the bristle cartridge with material that forms a handle.

**[0022]** Description 10: A method for forming a bristle cartridge, the method comprising: providing a plurality of bristle filaments arranged into a cluster having an end; positioning at least one spacer within the cluster proximate the end; and at least partially melting one of the at least one spacer and the plurality of bristles to join the

at least one spacer and the plurality of bristles.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0023]** FIGURE 1 is a top elevational view of a paint applicator according to one embodiment of the present invention.

**[0024]** FIGURE 2 is a top elevational view of a handle of the paint applicator of FIGURE 1 prior to complete assembly.

**[0025]** FIGURE 3 is a sectional view of the paint applicator of FIGURE 1 taken along line 3-3.

**[0026]** FIGURE 3A is a top elevational view of a first alternative embodiment of the paint applicator of FIGURE 1.

**[0027]** FIGURE 3B is a top elevational view of a handle of the paint applicator of FIGURE 3A prior to complete assembly.

**[0028]** FIGURE 3C is a sectional view of the handle of the paint applicator of FIGURE 3A taken along line 3C-3C.

**[0029]** FIGURE 4 is a top perspective view of a second alternative embodiment of the paint applicator of FIGURE 1 prior to complete assembly.

**[0030]** FIGURE 5 is a sectional view of the paint applicator of FIGURE 4 after being assembled.

**[0031]** FIGURE 5A is a sectional view of a first alternative embodiment of the paint applicator of FIGURE 5.

**[0032]** FIGURE 6 is a sectional view of a second alternative embodiment of the paint applicator of FIGURE 5.

**[0033]** FIGURE 7 is a sectional view of a paint applicator handle forming system illustrating the formation of a paint applicator handle.

**[0034]** FIGURE 8 is a sectional view of a first alternative embodiment of the system of FIGURE 7.

**[0035]** FIGURE 9 is a sectional view of a second alternative embodiment of the paint applicator handle forming system of FIGURE 7.

**[0036]** FIGURE 10 illustrates the paint applicator handle forming system of FIGURE 9 during the formation of a paint applicator handle.

**[0037]** FIGURE 11 is an enlarged view of the system of FIGURE 11 taken along line 11-11.

**[0038]** FIGURE 12 is a sectional view of the paint applicator handle forming system of FIGURE 7 further illustrating the formed handle being filled with a material.

**[0039]** FIGURE 13 is a fragmentary sectional view of a paint applicator handle forming system configured to form variously configured applicator handles.

**[0040]** FIGURE 14 is a sectional view of the system of FIGURE 13 taken along line 14-14.

**[0041]** FIGURE 15 is a sectional view of a first alternative embodiment of the system of FIGURE 13 taken along line 14-14.

**[0042]** FIGURE 16 is a sectional view of a paint applicator forming system according to one embodiment of the present invention.

**[0043]** FIGURE 17 is a fragmentary sectional view of a first alternative embodiment of the paint applicator forming system of FIGURE 16.

**[0044]** FIGURE 17A is a schematic view of a paint applicator handle forming system according to one embodiment of the present invention.

**[0045]** FIGURE 18 is a sectional view of a paint applicator bristle plug forming system forming a paint applicator bristle plug.

**[0046]** FIGURES 19 and 20 are fragmentary sectional views of a paint applicator forming system according to one embodiment of the present invention forming a paint applicator handle about a bristle plug.

**[0047]** FIGURE 21 is an enlarged view of the system of FIGURE 20 taken along line 21-21.

**[0048]** FIGURES 22 and 23 are fragmentary sectional views of a first alternative embodiment of the paint applicator forming system of FIGURES 19-21 illustrating the formation of a paint applicator.

**[0049]** FIGURE 24 is a fragmentary sectional view of a second alternative embodiment of the paint applicator forming system of FIGURES 19-21.

**[0050]** FIGURES 25 and 26 are fragmentary sectional views of a third alternative embodiment of the paint applicator forming system of FIGURES 19-21.

**[0051]** FIGURES 27 and 28 are fragmentary sectional views of a fourth alternative embodiment of the paint applicator forming system of FIGURES 19-21.

**[0052]** FIGURES 29 and 30 are fragmentary sectional views of a fifth alternative embodiment of the paint applicator forming system of FIGURES 19-21.

**[0053]** FIGURES 31 and 32 are fragmentary sectional views illustrating a method for forming a paint applicator bristle subassembly according to one embodiment of the present invention.

**[0054]** FIGURES 33 and 34 are fragmentary sectional views of an alternative embodiment of the method illustrated in FIGURES 31 and 32.

**[0055]** FIGURE 35 is a fragmentary top elevational view of a paint applicator forming system according to one embodiment of the present invention.

#### DETAILED DESCRIPTION

##### **I. PAINT BRUSH WITH CLAMSHELL HANDLE**

**[0056]** Figure 1 is a top elevational view of a paint applicator (illustrated as paint brush 10) generally including handle 12, bristles 14 and ferrule 16. Bristles 14 comprise a plurality of brush filaments 24 grouped together and interleaved by a plurality of wedges or spacers (not shown). Filaments 24 comprise conventionally known paint brush filaments formed from natural material such as hair or man-made material such as nylon. Filaments 24 serve as a paint carrying and applying medium. Alternatively, other mediums may be employed to carry and release paint onto a surface such as sponge, foam and a variety of other such materials. The spacers

are formed from cardboard, felt or plastic. Axial ends of filaments 24 are bound to one another and are bound to the spacers (not shown) by a conventionally known epoxy (not shown). This epoxy further secures bristles 14 to ferrule 16.

**[0057]** Ferrule 16 secures bristles 14 to handle 12. Ferrule 16 comprises a band of metal secured to and overlapping portion of handle 12.

**[0058]** Handle 12 generally includes gripping portion or shank 18 and head 20. Shank 18 comprises an elongate narrow portion of handle 12 configured for grasp by a user's hand. Head 20 widens from shank 18 and forms a wide surface to which ferrule 16 is secured and provides a surface against which brush 10 may be grasped by a user during painting. Handle 12 supports bristles 14 and ferrule 16. Handle 12 is easily manufactured, is lightweight and is relatively inexpensive as compared to conventional brush handles.

**[0059]** Figures 2 and 3 illustrate handle 12 in greater detail. Figure 2 is a top elevational view of handle 12 prior to the completed assembly of handle 12. Figure 3 is a sectional view of handle 12, once assembled, taken along lines 3 -- 3 of Figure 1. As best shown by Figure 2, handle 12 is generally formed from a pair of opposing handle clamshell halves 32, 34. Each clamshell half 32, 34 generally forms a shank half 36 and a head half 38. Shank halves 36 and head halves 38 are complementarily shaped so as to mate with one another and form shank 18 and head 20 of brush 12 when assembled together. Each of halves 32, 34 is preferably injection molded from a rigid polymeric material such as polyethylene. Alternatively other polymer or plastic materials may be used such as polypropylene, polyvinylchloride and the like.

**[0060]** To facilitate a secure coupling of clamshell halves 32, 34 together to form handle 12, each of halves 32, 34 is complementarily shaped with opposing male-female structures. In the exemplary embodiment, clamshell half 32 includes a plurality of female cavities 40 while clamshell half 34 includes a corresponding number of opposite male projections or protuberances 42. Female cavities 40 receive male protuberances 42 to insure proper alignment of clamshell halves 32 and 34 when handle 12 is assembled. As best shown by Figure 3, female cavities 40 and male protuberances 42 are preferably configured to resiliently flex when joined together such that clamshell halves 32 and 34 snap together and are retained in their assembled state. In particular, each of female cavities 40 includes a narrowing throat 44 which resiliently flexes to receive the enlarged head 46 of male protuberance 42. Clamshell halves 32, 34 may alternatively include other complementary male-female structures aligning halves 32 and 34 when assembled. For example, the perimeter edges of halves 32 and 34 may alternatively include complementary ribs and channels receiving such ribs. As will be appreciated, the complementary male and female structures on halves 32 and 34 may be intermixed such that a single

half contains both male and female structures. Although less desirable, clamshell halves 32, 34 may alternatively include structures which align with one another but which do not provide a snap-fit. Halves 32, 34 may also alternatively omit any such structures whereby other means are provided for securing halves 32 and 34 together such as adhesives, overmolds, welds or fusion bonds.

**[0061]** As shown by Figures 2 and 3, halves 32 and 34 each include a continuous peripheral wall 50 that extends about the entire perimeter of each of halves 32, 34 about an interior cavity 52. As a result, when halves 32, 34 are aligned opposite one another in an assembled state, handle 12 is generally hollow through both shank 18 and head 20. Because handle 12 is hollow, handle 12 requires less material and is lighter in weight. At the same time, handle 12 may be quickly and easily manufactured through simple injection molding equipment not requiring moveable inserts or cores.

**[0062]** As further shown by Figure 3, walls 50 of halves 32, 34 extend opposite to one another and abut one another when halves 32 and 34 are aligned with one another. Walls 50 abut one another about the entire perimeter of handle 12 including an axial end of head 20. As a result, handle 12 is structurally stronger and more rigid, allowing handle 12 to be formed from less expensive, less strong polymer or plastic materials. At the same time, walls 50 may be provided with a uniform wall thickness for easier manufacture and for reduction in material cost.

**[0063]** As shown by Figures 2 and 3, handle 12 additionally includes a living hinge 56 integrally formed as part of the single unitary body with both halves 32 and 34. Hinge 56 is preferably formed so as to span or bridge opposing side walls 50 of halves 32, 34 on head 20. Hinge 56 is preferably formed in the injection cycle or shot as halves 32 and 34. Hinge 56 facilitates assembly of halves 32 and 34 by providing and maintaining alignment of halves 32 and 34 at all times. As a result, once formed, halves 32 and 34 may be quickly and easily aligned and joined to one another by simply pivoting one of halves 32, 34 about hinge 56. As shown by Figure 3, in the exemplary embodiment, hinge 56 is preferably configured so as to extend into cavity 52 when halves 32 and 34 are assembled such that adjacent walls 50 remain substantially flush with one another to provide handle 12 a smooth outer surface for better gripping and for improved aesthetic appearance. Although less desirable, hinge 56 may alternatively be configured such that hinge 56 remains upon an adjacent and exterior of wall 50, wherein hinge 56 is left intact or is severed once halves 32 and 34 are joined.

**[0064]** Figures 3A, 3B and 3C illustrate paint applicator 10A, an alternative embodiment of applicator 10 shown in FIGURES 1-3. Applicator 10A is substantially identical to applicator 10, except that applicator 10A includes handle 12A. Handle 12A is similar to handle 12, except that handle 12A includes an outer elastomeric

layer 60 overlying halves 32 and 34. The elastomeric layer preferably comprises a paint solvent resistant elastomeric material such as SANTOPRENE, Alternatively, other elastomeric materials may be used. As best shown by Figures 38 and 3C, layer 60 preferably over-  
 lies the mating edge of wall 50 of half 32 along half's entire perimeter. As a result, when halves 32 and 34 are closed to form handle 12A, the upper perimeter edge of wall 50 of half 34 is compressed against layer 60 over-  
 lying the upper perimeter edge of wall 50 of half 32 to form a seal between halves 32 and 34 at their junction. Thus, in addition to providing handle 12A with a soft elastomeric grippable outer surface, layer 60 also serves as a gasket between halves 32 and 34 to form a seal therebetween.

**[0065]** Although layer 60 is illustrated as preferably overlying the exterior surfaces of both halves 32 and 34, layer 60 may alternatively extend along only portions of halves 32 and 34, and may have varying thicknesses so as to form finger locators and the like. In alternative embod-  
 iments, layer 60 may only extend along the upper perimeter mating edge of one of halves 32 and 34. More-  
 over, in yet another alternative embodiment, layer 60 may overlies mating edges of walls 50 of both halves 32 and 34.

**[0066]** Figures 4 and 5 illustrate brush 110, an alternative embodiment of applicator 10 shown in Figures 1-3. Brush 110 includes handle 112, bristles 14 and fer-  
 rule 116. Handle 112 is similar to handle 12 except that handle 12 omits portions of wall 50 along the axial end of head 20 to form mouth 111 which communicates with  
 cavity 52 of head 20. As best shown by Figure 5, each of halves 32, 34 further includes grooves or detents 113 configured to fit with corresponding ribs 115 of ferrule 116. Although grooves 113 preferably continuously extend along the inner circumferential surface of head 20 when halves 32 and 34 are joined, grooves 113 may al-  
 ternatively only partially extend along the inner circum-  
 ferential surface of cavity 52. For ease of illustration, the remaining components of brush 110 which correspond to similar components of brush 10 are numbered simi-  
 larly.

**[0067]** Ferrule 116, like ferrule 16, receives axial ends of brush filaments 24 as well as the interleaved spacers and epoxy (not shown). Ferrule 116 also joins bristles 14 to handle 112. However, unlike ferrule 16, ferrule 116 is received through mouth 111 into cavities 52 between halves 32 and 34. In the exemplary embodiment, ferrule 116 includes ribs 115 which snap into grooves 113 of head 20. In the exemplary embodiment, ferrule 116 is  
 formed from a polymer or plastic such as polyethylene having a sufficient degree of resilient flexibility to allow ribs 115 to flex so as to be inserted through mouth 111 until reaching corresponding grooves 113. As a result, ribs 115 and grooves 113 form a mechanical interlock securing ferrule 116 to head 20. Alternatively, ferrule 116 may be retained within cavities 52 of head 20 between halves 32 and 34 by other means such as being press

fit, by means of epoxy or other adhesives, by fusion bonds or welds. Although less desirable, ferrule 116 may be secured to head 20 by means of fasteners ex-  
 tending through head 20 into ferrule 116. Because head 20 of handle 112 receives ferrule 116, head 20 may be provided with a smooth exterior surface omitting the edges or fasteners usually associated with an exterior ferrule. Although the exterior surface of head 20 of han-  
 dle 112 is illustrated as being generally flat, head 20 as well as the remaining portions of handle 112 may alter-  
 natively be configured to provide various surface con-  
 tours to provide easier gripping such as those set forth and described in co-pending U.S. Provisional Patent Application Serial No. 60/193,219, entitled "Paint Ac-  
 cessories" filed on March 30, 2000 by Brian E. Wood-  
 north, Michael J. Walsh, Brian C. Bone, Heath A. Doty, Kent P. Ritzel, William Dean Ungar, Mark A. Gilbertson, John W. Grosz, Timothy D. Killinger and Aaron W. Smith, the full disclosure of which is hereby incorporated  
 by reference.

**[0068]** Handles 12 and 112 of paint brushes 10 and 110, respectively, are each illustrated and described as including a pair of opposing halves which join together to form the entirety of the respective handle. Alternative-  
 ly, each of handles 12 and 112 may be configured to be composed of greater than two sections which join or possibly mate with one another to form a handle of a paint brush or a paint applicator. For example, in one alternative embodiment, such a handle would alterna-  
 tively include three sections which join or mate together to form a complete handle. In particular, the sections would include a middle section and two substantially identical side sections. The middle section is hinged on opposite sides to the two side sections, such that when the sections are in an open position, the sections would form the shape of an "N" wherein the "I" comprises each of the two side sections and wherein the "V" comprises the middle section. In a closed position, the three sec-  
 tions would be substantially parallel to one another, wherein the opposite faces of the brush handle would be formed by the side sections and wherein the middle section would join the two side sections and provide in-  
 creased structural stability.

**[0069]** In yet another alternative embodiment, only a portion of the paint applicator handle is provided by two at least partially hollow sections which mate with one another or join to one another to form a portion of the handle. For example, in one particular embodiment, only the shank is formed by two opposing hollow halves which mate together while the head of the handle is connected to the shank and is either formed as a solid mem-  
 ber for mounting to bristles or other paint applying me-  
 dium in a similar fashion to that of brush 10 or is cored out to be joined to bristles or another paint applying me-  
 dium in a fashion similar to brush 110.

**[0070]** Figure 5A illustrates paint applicator 110A (shown as a brush), an alternative embodiment of brush 110 shown in Figures 4 and 5. Applicator 110A is similar

to applicator 110 except that applicator 110A includes handle 112A. Handle 112A is similar to handle 112, except that handle 112A includes an elastomeric layer 160 of material overlying the exterior surface of each of halves 32 and 34 in a similar fashion to that of layer 160 in applicator 10A. However, as shown in Figure 5A, layer 160 further extends around mouth 11 and into cavity 52 between halves 32 and 34 so as to line the interior cavity of handle 112A which receives ferrule 116. Because layer 160 is elastomeric, layer 160 is capable of being slightly compressed when ferrule 116 is positioned within cavities 52. At the same time, layer 160 grips ribs 115 of ferrule 116 to retain ferrule 116 within cavities 52. In addition to securing ferrule 116, layer 160 further forms a seal against ferrule 116 to prevent the undesirable ingress of paint into the interior of handle 112A. Although layer 160 within cavity 52 is illustrated as being preferably smooth prior to being compressed by ribs 115, layer 160 may alternatively be provided with ribs, notches or ratcheting teeth configured to engage ferrule 116 or alternatively configured ferrules so as to secure bristles 14 or alternative paint applying mediums to handle 112A.

**[0071]** Figure 6 illustrates brush 210, an alternative embodiment of brush 10. Brush 210 is similar to brush 110 (shown in Figures 4 and 5) except that brush 210 includes an outer layer 217 of material overlying substantially the entire exterior periphery of handle 112 and extending across the junction formed by adjoining edges 219 of walls 50 of halves 32, 34. As a result, halves 32, 34 are further retained in alignment with one another and held adjacent to one another even in those particular applications where mechanical interlocks, adhesives or other means for securing halves 32 and 34 together are not provided. Moreover, layer 217 also provides a smooth continuous exterior surface to handle 112 overlapping the edges or crevices. Consequently, handle 112 of brush 210 is more comfortable to grip. To further facilitate a comfortable grip, layer 217 is preferably formed from a soft, compressible, rubber-like material such as an elastomer that is resistant to solvents commonly used with paint brushes. One common elastomer comprises SANTOPRENE sold by Advanced Elastomer Systems. Although less desirable, layer 217 may alternatively comprise a rigid polymeric material.

**[0072]** In addition to providing handle 112 a smooth exterior surface, providing a more comfortable grip, and retaining halves 32 and 34 in an aligned assembled state, layer 217 also seals across edges 219. As a result, the ingress of paint, solvents or other materials between edges 219 into cavities 52 is substantially minimized or eliminated. As an added benefit, layer 217 also provides handle 112 with a continuous outer appearance which is more aesthetically pleasing.

**[0073]** In the exemplary embodiment, layer 217 preferably has a thickness of approximately 0.060 inches. Layer 217 is preferably molded about halves 32, 34. Although not illustrated, layer 217 is preferably secured to

halves 32 and 34 by being heat fused thereto or by mechanical interlocks between layer 217 and halves 32, 34. For example, halves 32, 34 may be provided with radially extending projections that extend through layer 217 to form a mechanical interlock. Such mechanical interlocks are illustrated in U.S. Patent No. 6,138,313 entitled "Paint Brush with Improved Grip Construction and Method of Manufacture Thereof", the full disclosure of which is hereby incorporated by reference.

## **II. CONTINUOUS HOLLOW PAINT BRUSH HANDLE AND METHOD OF MANUFACTURE**

**[0074]** Figures 7 and 8 illustrate a method of manufacturing paint brush handle 312. Handle 312 is shown completed and in section in Figure 8. As best shown by Figure 7, handle 312 is preferably formed using mold 314, extrusion blow molding apparatus 316 and end mold 318. Mold 314 generally consists of a pair of opposing mold halves or segments 322, 324 (halves is not intended to limit a mold to only two segments) which mate to form an internal mold cavity 326 generally in the shape of paint brush handle 312. In particular, cavity 326, formed by joined halves 322 and 324, has an enlarged head portion 328 communicating with a narrower shank portion 330 which extends through an end of mold halves 322, 324 to provide an opening into cavity 326. As further shown by Figures 7 and 8, each half 322, 324 includes vacuum assist ports 332 connected to a vacuum source (not shown).

**[0075]** Extrusion blow molding apparatus 316 is conventionally known and generally includes extrusion die 334 and nozzle 336. Extrusion die 334 is fluidly coupled to a source of fluid or semi-fluid handle material (not shown) and is configured to extrude a balloon of the material called a parafin. In the exemplary embodiment, apparatus 316 is configured to extrude a parafin of material into cavity 326.

**[0076]** Nozzle 336 projects into the interior of the parafin and is coupled to a source of pressurized gas. In operation, as shown by Figure 7, a parafin of material is extruded by die 334 into cavity 326 as indicated by arrows 338. Afterward, air is injected into the interior of the parafin through nozzle 336 to blow up or expand the parafin against the interior of cavity 326 as indicated by arrows 340. To further assist the parafin in contacting the interior of cavity 326, vacuum pressure is applied through port 332 as indicated by arrows 342. During these steps, both halves 322 and 324 are pressed together as indicated by arrows 344 and end die 318 is retracted as indicated by arrow 346.

**[0077]** Once the parafin has been completely blown adjacent to and in contact with the interior walls of cavity 326, apparatus 316 is withdrawn, as indicated by arrow 348, and end die 318 is inserted in between halves 322, 324 as indicated by arrow 350. End die 318 closes the end of the parafin while the parafin is in a partially formable state. After the material forming parafin has sub-

stantially cooled and solidified, halves 322, 324 and end die 318 are withdrawn, leaving brush handle 312. As shown by Figure 8, the resulting brush handle 312 is generally hollow having a cavity 354 and continuous solid wall 356 extending about cavity 354. Because handle 312 is hollow, handle 312 is lightweight, requires less material and can be quickly and efficiently manufactured at a lower cost. Because walls 356 are substantially continuous, handle 312 does not include any edges or joints where halves would otherwise come together such as with brush 10. Because walls 356 are continuous, brush 312 is structurally stronger, enabling less expensive less strong materials to be employed in the manufacture of brush 312.

**[0078]** In the exemplary embodiment, brush 312 is preferably formed from an expandable polymer such as polyethylene or polypropylene. Alternatively, brush 312 may be formed from various other polymeric materials. Although brush 312 is illustrated as having the general configuration shown in Figures 7 and 8, brush 312 may alternatively have the various configurations set forth in the appended provisional application. Moreover, brush 312 may additionally include an overlying layer of soft, compressible, rubber-like material such as an elastomer. Once completed, brush handle 312 is secured to ferrule 16 and bristles 14 as described above.

**[0079]** In lieu of employing end die 318, handle molding system 310 may alternatively include an extrusion and blow molding apparatus 316 configured to close the open end of the parafin upon withdrawal from mold 314.

**[0080]** Figures 9-11 illustrate brush handle molding system 410, an alternative embodiment of brush molding system 310 described above. Brush handle molding system 410 is configured to produce a completed brush handle 412 (shown in Figures 10 and 11) and generally includes mold 414 including mold halves 422, 424 and heating members 432. Mold halves 422, 424 extend opposite one another and form cavity 426 when joined. Cavity 426 is configured in the general shape of a paint brush handle. When joined together, halves 422, 424 further define port 428 pneumatically connectable to a source of pressurized gas. Cavity 426 is configured to receive preform 430 as shown in Figure 9.

**[0081]** Preform 430 generally comprises an elongate tubular shaped member formed from a thermoplastic polymeric material such as polyethylene or polypropylene. Alternatively, preform 430 may be formed from other thermoplastic materials. Preform 430 is preferably preformed by injection molding that includes a detailed head portion 419 including injection molded detents or grooves 413. Because head portion 419 is injection molded, the size and location of grooves 413 may be controlled to precise tolerances.

**[0082]** Preform 430 further includes shank portion 417 sized smaller than the surrounding cavity 426 of mold 414. As best shown by Figure 11, heating members 432 elevate the temperature of shank portion 417 such that shank portion 417 is formable. Once attaining

a sufficient temperature, pressurized gas is directed into cavity 426 through port 428 as indicated by arrows 434. The pressurized gas expands shank portion 417 of preform 430 outward towards the inner surface of cavity 426. In addition, gas assist may be used as a vacuum to draw shank portion 417 of preform 430 outward towards the inner surface of cavity 426. After allowing sufficient time for cooling and solidifying, mold halves 422, 424 are separated and a completed brush handle 412 is removed.

**[0083]** The completed brush handle 412 is generally hollow through its head 420 and its shank 418. As a result, handle 412 is lightweight and uses less materials. As shown by Figure 11, handle 412 generally has a continuous outer wall, omitting any ridges, adjoining edges or junctures such as those found in handle 12. Consequently, brush handle 412 is stronger, is more comfortable to the grip and is more aesthetically pleasing. In addition, handle 412 has a generally sealed or closed wall about its cavity 452 which is open ended for the reception of a ferrule and bristles such as ferrule 116 and bristles 14 shown in Figure 4. At the same time, however, head 420 may include intricately formed grooves or other surface configurations for providing a mechanical lock with ferrule 116 or an alternatively configured ferrule. Although less desirable, brush handle 412 may alternatively omit grooves 413 where the ferrule is crimped, adhesively bonded, welded or fused to handle 412. As will be appreciated, various other complementary male and female structures may be used to secure a ferrule within head 420. For example, head 420 may alternatively include ribs or other male projections configured to extend into corresponding female cavities or grooves in the ferrule to thereby form a mechanical lock between handle 412 and the received ferrule.

**[0084]** In yet another alternative embodiment, premolded or preformed elastomer inserts may be positioned within either cavity 326 or cavity 426 or held in place in such molds as the parafin or preform is blown (with or without vacuum assist) in the appropriate shape within the mold interior. In such an alternative method, the parafin or preform would be preferably formed from a compatible material as the elastomer insert so as to fuse or bond thereto. Alternatively, the insert or interior mold shape may be configured such that the parafin or preform at least partially molds about the insert to form a mechanical interlock with the insert or to at least partially encapsulate the insert. Such an ability to provide a premolded elastomer insert facilitates providing the completed handle with more details along its exterior surface than would otherwise be economically achieved through conventional blow molding practices.

**[0085]** As described above, each of brush handles 12, 112, 212, 312 and 412 have a generally hollow head as well as a generally hollow shank. Because such handles are hollow, such handles are lighter in weight and use less materials. However, it is also contemplated that the hollow cavities of each of brush handles 12, 112, 212,



312 and 412 may alternatively be filled to improve the structural strength or where a more solid brush is desired. Preferably, the hollow cavities of such brushes are filled with a foam or a material including a foaming agent so as to fill the cavity yet maintain the lightweight quality of the brush handle. As will be appreciated, in those applications in which the head portion of the brush handle internally receives a ferrule, the filler is injected into the cavity about an insert so as to allow continued receipt of the ferrule. It is also contemplated in some applications where the head of the handle internally receives the ferrule, the ferrule would first be inserted into the cavity and then the filler material such as a foam material would be injected into the cavity about the ferrule.

**[0086]** Figure 12 illustrates but one example of an internal cavity of the above described brush handles being filled with a foam or a foamed material 513. In particular, Figure 12 illustrates brush handle 312 being formed by system 310. However, as shown by Figure 12, prior to closing of the shank 318 by end mold 323, foam material 513 is injected into cavity 352 through end mold 323. Alternatively, a foam material 513 may be injected into cavity 352 through nozzle 336 or through other injection devices. The resulting modified brush 312 has all the advantages associated with handle 312, yet is structurally stronger due to the omission of the hollow interior. As a result, the material forming the outer walls of brush handle 312 may consist of a lighter less strong material or may have a reduced thickness. In fact, when filler 513 is formed from a foam material having sufficient structural strength itself, the outer wall of revised handle 312 need not be structurally rigid. For example, outer wall 350 of revised brush handle 312 may alternatively comprise a soft, compressible, rubber-like material such as an elastomer like SANTOPRENE sold by Advanced Elastomer Systems. As a result, the resulting brush handle would provide the user with a soft comfortable grip. In other applications, filler 513 may be formed from a strong yet somewhat compressible foam material further increasing the conformability of brush handle 512 to a user's hand upon being gripped.

### **III. VARIABLE PAINT APPLICATOR FORMING SYSTEMS AND APPLICATOR HANDLE**

**[0087]** Figures 13-15 illustrate applicator handle forming system 610. System 610 enables the production of multiple paint brushes having a commonly sized and configured handle outer surface and outer configuration formed from a common mold, yet having differently sized or dimensioned paint applying mediums such as bristle groups or clusters for different painting applications. Alternatively, the paint applying medium may comprise other materials capable of carrying and releasing paint, varnishes, stains or other liquid coatings onto a surface such as foam material, sponge material or any of a variety of other presently known or future developed materials capable of performing such func-

tions. In the illustrated embodiment, the paint applying medium is coupled to a mounting portion, such as a ferrule, to form a paint carrying unit. Alternately, other mounting portions such as the plugs described herein may be used in lieu of a ferrule. The exact configuration and type of mounting portion may vary depending upon a type of paint applying medium or mediums coupled to the handle by the mounting portion.

**[0088]** As best shown by Figure 13, system 610 generally includes mold 614 and mold inserts 615A, 615B and 615C. Mold 614 comprises an injection molding mold and opposing mold halves 617, 619. Halves 617, 619, when joined together, define an internal cavity 626. Cavity 626 is in the general shape of a paint brush handle having a shank portion 621 and a head portion 623. At least one of shank portion 621 or head portion 623 of cavity 626 is in communication with a source of fluid handle material such as a polymeric material. Typical polymeric materials include polyethylene, polypropylene, and the like. Head portion 623 is in communication with shank portion 621 and has an open axial end 625 sized to partially receive a selected one of inserts 615A, 615B and 615C. When injected with a material, cavity 626 forms a brush handle having an exterior surface similar to that of brush handle 412 shown in Figure 11.

**[0089]** Inserts 615A, 615B and 615C comprise internal cores adapted to be received within cavity 426 during the injection molding process. Inserts 615A, 615B, 615C generally include end cap portions 627A, 627B, 627C and handle cavity-forming portions 629A, 629B and 629C. End cap portions 627A, 627B and 627C are substantially identical to one another and extend outwardly from handle cavity-forming portions 629A, 629B and 629C, respectively, to seal against mold 617 when portion 629A, 629B and 629C project into cavity 626. As will be appreciated, inserts 615A, 615B and 615C may alternatively omit such end cap portions where other structures are provided for sealing opening 625 and for supporting portion 629A, 629B or 629C in cavity 626.

**[0090]** Handle-forming portions 629A, 629B and 629C are each substantially identical to one another except that each portion 629A, 629B and 629C has at least one different dimension. In the exemplary embodiment, portions 629A, 629B and 629C have different heights H1, H2 and H3, respectively, as shown in Figure 13. As shown in Figure 14, portions 629A, 629B and 629C have different widths W1, W2 and W3, respectively. As a result, the resulting height and width of brush handle cavity 652 also varies. In particular, insert 615A forms a cavity 652A having a corresponding height H1 and a width W1 capable of entirely receiving a smaller ferrule having an outer height of H1 and an outer width of W1 and carrying bristles. Insert 615B forms a cavity 652B having a height H2 and a width W2 capable of securely receiving a slightly larger ferrule having an outer surface height H2 and an outer surface width W2 and carrying a slightly larger group of bristles. Lastly, insert 615C forms a cavity 652C having a height H3 and a width W3 capable of

securely receiving a slightly larger ferrule having a height H3 and a width W3 carrying a slightly larger group of bristles.

**[0091]** In operation, a selected one of inserts 615A, 615B and 615C is partially inserted into cavity 626. Material, such as polypropylene, polyethylene or other injection molding handle material is then injected into cavity 626 about the selected one of inserts 615A, 615B or 615C. After the material has sufficiently cooled or solidified, the insert is withdrawn leaving a handle with an inner cavity 652A, 652B or 652C, depending upon the insert employed. A ferrule carrying a group of bristles such as ferrule 116 and bristles 14 shown in Figure 14 is then inserted into the cavity 652A, 652B or 652C to form the resulting brush. Each ferrule and group of bristles inserted into cavity 652A, 652B or 652C will have a varying height and width dimension and will carry a variably dimensioned group of bristles. Thus, system 610 produces a multitude of differently sized paint brushes having differently sized groups of bristles for various applications such as trim, detailed painting and the like, yet having a commonly sized handle exterior to allow a user to become accustomed to gripping a particular handle exterior or configuration. Each of the differently sized brushes having a common brush handle is formed from a single system 610 having a single mold 614. As will be appreciated, the outer exterior surface of the brush formed by 610 may have any one of a variety of alternative configurations. For example, the outer exterior surface of the brush formed by system 610 may be configured similar to those brush handles shown in copending U.S. Application Serial No. 60/193,219 filed on March 30, 2000 by Brian E. Woodnorth, Brian C. Bone, Heath A. Doty, Kent P. Ritzel, William Dean Ungar, Christina L. Fortner, Jonathan Hawley, Daniel T. Williams and Brian Chiaruttini and entitled EASY GRIP PAINT APPLICATOR, the full disclosure of which is hereby incorporated by reference.

**[0092]** As further shown by Figure 14, the use of different inserts 615A, 615B and 615C results in head portion 620 extending from shank portion 618 to have a wall about cavity 652A, 652B or 652C with varying interior height and width dimensions while maintaining the same exterior dimensions. Figure 15 illustrates head portion 720 of paint brush handle 712 within mold 614 prior to removal of insert 715A. Insert 715A is substantially identical to insert 615A except that insert 715A includes projections 754 which provide head portion 720 with ribs 756 which extend towards cavity 752A. In particular, the inwardly extending surfaces of ribs 756 define the outer boundary of cavity 752A and engage the outer surface of an inserted ferrule. Overall, insert 715A forms cavity 752A which is substantially identical in size to cavity 652A. However, because head portion 720 includes ribs 756 provided by insert 715A, the walls of head portion 720 about cavity 752A require less material and provide head 720 with an overall lighter weight.

**[0093]** As shown by Figure 13, each of inserts 615A,

615B and 615C preferably includes outwardly extending groove forming portions 757 which are configured to form grooves 713 similar to groove 113 which are described with respect to Figure 5. Groove 713 receive corresponding ribs to mechanically interlock a ferrule within the interior of head portion 620 of brush handle 612. Alternatively, inserts 615A, 615B and 615C may be provided with various other exterior molding surfaces forming other mechanical interlocking depressions or projections along the inner surface of interior cavity 652A, 652B and 652C of head portion 620. In such applications, a particular insert chosen must be withdrawn from mold 614 at an appropriate time so as to not damage the molded interior surface of head 620, such as when head portion 620 is somewhat resiliently flexible during solidification or cooling. In lieu of forming groove 713, inserts 615A, 615B and 615C may each be alternatively configured to form rubber-like resilient gripping ribs (similar to ribs 756 seen in Figure 15) which resiliently flex when receiving the ferrule but which retain and hold the ferrule within the cavity of the handle. Although less desirable, inserts 615A, 615B and 615C may alternatively be configured to form a smooth inner cavity lacking grooves, depressions, or projections. In such applications, other adhesives, fasteners or other structures may be used to secure the ferrule within the cavity such as those described with respect to brush 110.

**[0094]** In the exemplary embodiment, halves 617, 619 of mold 614 are formed from steel, while inserts 615A, 615B, 615C and 715A are formed from steel. The material injected into cavity 626 about the inserts preferably comprises polypropylene, polyethylene, blends thereof, or other polymeric material. Other materials such as ceramic materials may also be employed. Although inserts 615A, 615B and 615C are illustrated as having different heights H1, H2 and H3 and different widths W1, W2 and W3, inserts 615A, 615B and 615C may additionally be provided with differing lengths. Depending upon the desired dimensions of the ferrule and group of bristles carried by the ferrule, inserts 615A, 615B and 615C may have differing heights, widths and lengths singly or in combination.

**[0095]** Figure 16 illustrates paint brush forming system 810. Paint brush forming system 810 provides multiple paint brushes having differently dimensioned groups of bristles for different applications such as performing trim, general painting and the like, yet having identically dimensioned and configured handle exteriors formed from a common tool. As with paint brush handles 612 and 712 discussed above, paint brush handle 812 provides multiple differently sized brushes having a common handle which enables the user to become acquainted and skilled in gripping the different paint brushes and reduces the manufacturing and packaging costs. As shown by Figure 16, system 810 generally employs handle 812 and differently sized bristle cartridges 815A, 815B and 815C. Handle 812 generally includes shank 818 and head 820 which includes an interior cavity 852.

Shank 818 is substantially identical to shank 318 shown in Figure 12 and has the same general shape as shank 18 shown in Figure 1. Head 820 is substantially identical to head 20 shown in Figure 4 and includes grooves 113 adjacent cavity 852. Cavity 852 receives each of bristle cartridges 815A, 815B or 815C.

**[0096]** Bristle cartridges 815A, 815B and 815C are substantially identical to one another except that each cartridge 815A, 815B and 815C has a differently dimensioned ferrule 816A, 816B and 816C carrying a differently dimensioned group of bristles 814A, 814B, 814C. In particular, each cartridge 815A, 815B and 815C generally includes a differently sized ferrule 816A, 816B, 816C and a differently sized group of bristles, 814A, 814B, 814C. Groups of bristles 814A, 814B, 814C have groups or clusters of bristle filaments 824 which are secured within corresponding ferrules 816A, 816B and 816C, respectively, by epoxy 826 or other adhesive of polymeric material and have differing bristle height dimensions BH1, BH2 and BH3, respectively. Although not illustrated, groups of bristles 814A, 814B and 814C may additionally or alternatively be provided with varying or differing width dimensions (extending into the page). To enable such variably dimensioned groups of bristles, 814A, 814B and 814C to fit within a commonly sized cavity 852 of handle 812, ferrules 816A, 816B and 816C have differing thicknesses T1, T2 and T3, respectively. Overall, the dimensional change between bristle groups 814A, 814B and 814C, whether height, width or length, are generally offset by a corresponding opposite change in dimension, whether height, width or length, of ferrules 816A, 816B and 816C. In the exemplary embodiment, ferrules 816A, 816B and 816C are formed from a polymeric material such as nylon, polypropylene, polyethylene or the like. As a result, ferrules 816A, 816B and 816C may be easily molded and provided with the differing dimensional values that enable differently sized groups of bristles 814A, 814B and 814C to be secured to a commonly sized brush handle 812 within cavity 852,

**[0097]** Figure 17 illustrates paint brush forming system 910. System 910 provides a plurality of differently sized paint brushes having differently dimensioned groups of bristles while also having a commonly sized handle to enable quicker and more reliable gripping of the paint brush handle independent of the particular painting application in which differently dimensioned groups of bristles are required. System 910 generally includes handle 912 and bristle cartridges 915A, 915B and 915C. Handle 912 is substantially similar to handle 12 shown in Figure 1. Alternatively, handle 12 is substantially similar to handle 112 shown in Figure 4, handle 312 shown in Figure 8 or handle 312 shown in Figure 12. Handle 912 may have various outer surface contours and configurations such as illustrated and described in the appended Provisional Application Serial No. 60/193,219. Handle 912 is configured for use with each of cartridges 915A, 915B and 915C.

**[0098]** Cartridges 915A, 915B and 915C are substan-

tially identical to one another except that each of cartridges 915A, 915B and 915C has a differently dimensioned group of bristles 914A, 914B, 915C and a differently dimensioned ferrule 916A, 916B and 916C. Bristle groups 914A, 914B and 914C have differing heights BH4, BH5 and BH6, respectively, and are generally composed of a plurality of grouped individual bristle filaments 924 comprised of natural or artificial materials such as hair, nylon, polyester, polyolefins or blends thereof which are interleaved with spacers (not shown) and which are secured to one another and to ferrules 916A, 916B, 916C by epoxy 925 or other adhesives of polymeric material binders. Bristle groups 914A, 914B and 914C are selectively secured to handle 912 by ferrules 916A, 916B and 916C, respectively.

**[0099]** Each ferrule 916A, 916B and 916C is substantially similar but is differently dimensioned to accommodate the corresponding differently sized bristle group. Each ferrule 916A, 916B and 916C generally includes outer wall 928 defining opening 930 and rib 932. Wall 928 extends about the end of bristle groups 914A, 914B, 914C. As shown by Figure 17, outer wall 928 of ferrule 916A has a uniform thickness FT1 overlapping handle 912 and overlapping bristle group 914A. However, outer walls 928 of cartridge 915B and 915C have a varying thickness across their longitudinal length. In particular, ferrule 916B has a ferrule thickness FT2 while outer wall 928 of ferrule 916C has a ferrule thickness FT3. At the same time, those portions of outer wall 928 about bristle groups 914B and 914C have a larger inner diameter to accommodate the increased volume of filaments 924. The increased thickness of outer wall 928 of each of ferrules 916B and 916C enables opening 930 of each of cartridges 915A, 915B and 915C to be uniformly sized for receiving the portion of head 920 of handle 912. As a result, each of cartridges 915A, 915B and 915C may be mounted upon handle 912 to form a differently sized paint brush. To further facilitate retention of ferrules 915A, 915B and 915C, each ferrule includes rib 932 which resiliently flexes and snaps into corresponding groove 936 formed in an exterior surface of handle 912. Although less desirable, ferrules 916A, 916B and 916C may alternatively be secured over and about portions of head 920 of handle 912 by other means such as adhesive, fusion, welding, crimping or fasteners that extend through the ferrule into handle 912.

**[0100]** Moreover, handle 912 (the exposed portion) may then be overcoated with a layer of rigid or soft compressible elastomeric material to provide the paint brush with a continuous, uninterrupted outer exterior surface. In an alternative embodiment, both handle 912 (the exposed portion) and ferrule 916 are overlaid with a layer of rigid or soft compressible elastomeric material or a rigid polymeric material. In one alternative embodiment, the layer is thinner across ferrule 916 yet is thicker over handle 912 where handle 912 is exposed adjacent to ferrule 916 to provide the paint brush with a smooth, continuous uninterrupted outer exterior surface.

**[0101]** Each of the above-described paint applicators 610, 710, 810 and 910 have a common exterior shank and head configuration while providing a plurality of distinct paint applying medium configurations. For example, paint applicator 610 has a common exterior shank and head configuration (shape and configuration) while having a cluster of paint bristles which have varying overall widths and thicknesses. As noted above, this feature enables a user to become accustomed to gripping the same exterior configuration while utilizing a brush having a bristle configuration best suited for a particular application. In addition to varying the paint applying medium configuration or bristle configuration, while maintaining the same exterior configuration of the head of the brush handle, it may also be desirable to vary the exterior configuration of the shank portion of the handle while maintaining the same exterior head configuration. Accordingly, according to yet another embodiment, the head portion of the handle would be configured to be releasably mounted to one of a variety of shanks having various shank configurations such as long, short, beaver-tail and the like. In lieu of the handle having a shank portion releasably mounted to a common configured head portion, inserts configured to form one of various desirable paint brush handle shank configurations such as long, short, beaver-tail and the like, may be inserted within a generic mold to enable the single generic mold to form a multiple of paint brushes having a common exterior head configuration yet varying shank portion configurations. In lieu of employing inserts, the mold halves forming the head may be comprised of multiple interchangeable sections, wherein the configuration of the shank portion of a handle may be easily varied by interchanging sections in a mold.

**[0102]** Figure 17A schematically illustrates brush forming system 950 for forming variously configured paint applicator handles. System 950 generally includes frame 952, mold sections 954A, 954B, 954C, 956A, 956B, and 956C. Frame 952 comprises a structural frame support or other mechanism configured to releasably hold and retain one of mold sections 954A, 954B and 954C adjacent to one of mold sections 956A, 956B, 956C. Frame 952 allows mold section 954A, 954B and 954C to be selectively interchanged with one another, and allows mold sections 956A, 956B and 956C to be selectively interchanged with one another to particularly and easily produce differently configured brush handles. In particular, mold sections 954A, 954B and 954C preferably comprise molds having internal cavities configured to form differently configured paint applicator handle shank portions. For example, mold section 954A is configured to form a conventionally known long shank configuration, mold section 954B is configured to form a conventionally known short shank handle portion while mold section 954C is configured to form a conventionally known beaver-tail shank paint applicator handle configuration. Mold sections 956A, 956B and 956C are configured to form differently configured head portions

of a paint applicator handle. In one preferred embodiment, mold sections 954 and 956 are interchanged with one another by means of a rotatable turret to rotate to selectively position one of the sections 954 and one of sections 956 within frame 952. Once positioned within frame 952 adjacent to one another, paint applicator handle material, such as polyethylene or the like, is injected into the interior of the mold sections within frame 952 or is blown into the interior of mold sections 952 to form the desired handle. Thereafter, the mold sections within frame 952 are separated and the resulting paint brush is removed.

**[0103]** Alternative configurations may be employed to interchange mold sections 954 and 956. For example, mold sections 954 and 956 may alternatively be interchanged in and out of frame 952 by means of a track or other mechanisms which permit movement of components relative to one another. The interchange of mold sections may be performed manually or may be done by various actuation mechanisms which rely on hydraulic, pneumatic, electrical or mechanical actuation mechanisms. Moreover, the interchange of mold sections into and out of frame 952 may be under manual control or may be under the control of a control circuit configured to generate control signals which one or more actuators respond to by interchanging mold sections 954 and 956. The control circuit may also be configured to control the type of paint applicator handle material being injected or blown into the interior of the mold to further control the qualities of the selected paint applicator handle being formed.

#### **IV. BRISTLE PLUG AND METHODS OF BRUSH MANUFACTURE USING PLUG**

**[0104]** Figure 18 illustrates plug forming method 1010. Figure 18 illustrates the formation of bristle plug 1016 by mold 1014 including halves 1016, 1018. As shown by Figure 18, halves 1016, 1018, when joined together, form an annular mold 1014 having an internal cavity 1015. To form bristle plug 1016, bristle filaments 1024 are grouped and are pulled through cavity 1015. Wedges or spacers 1025 are then inserted or interleaved between ends of bristle filaments 1024 which are pulled back through cavity 1015. Alternatively, spacers 1025 may be positioned between and among filaments 1024 by various other methods. Once ends of filaments 1024 and spacers 1025 are positioned within cavity 1015, a fluid plug material is injected or supplied into cavity 1015, preferably under low pressure. The fluid plug material preferably penetrates bristle filaments 1024 so as to contact bristle filaments 1024 and spacers 1025. Upon solidifying or hardening, the material secures filaments 1024 and spacers 1025 together and in place and at the same time forms body 1028. Body 1028 preferably includes at least one mechanical locking structure 1030 distant filaments 1024 and at least one locking structure 1032 proximate filaments 1024. Struc-

tures 1030 and 1032 enable body 1028 and plug 1016 to be more securely fixed to a surrounding brush handle. As will be appreciated, locking structures 1030 and 1032 may comprise male or female structures. Although less desirable, locking structures 1030 and 1032 may be omitted where other means are provided for securing plug 1016 to a handle.

**[0105]** In the illustrated embodiment, the plug material securing filaments 1024 together and to spacers 1025 and forming body 1028 comprises an epoxy, a polymer or resin, or mixture thereof. Preferably, the material forming body 1028 is capable of forming strong bonds with the material of filaments 1024. Preferably, the material has a tie-layer such as an anhydride acid modified polymer compatible with polypropylene which would enable body 1028 and the material comprising it to bond to normally incompatible filaments 1024 formed from nylon, polyester or polyolefins and to bond to the polypropylene handle while being resistant to most solvents used in painting applications. Such an acid modified polypropylene is commonly sold under the trademark BYNEL produced and sold by DuPont. Other binding materials which body 1028 may be formed from include polyethyleneterephthalate (PETA), polyethylene, polypropylene or other hardening materials. In applications where plug 1016 is heat fused to a handle, the material forming body 1028 should preferably be formed from a thermoplastic polymer. In less preferred embodiments, a thermoset material such as polyurethane or an epoxy may be employed.

**[0106]** Overall, plug 1016 retains bristle filaments 1024 and spacers 1025 together while providing a body 1028 having a large surface area for being mechanically locked, bonded, welded, fused or otherwise secured to and within an internal cavity of a brush handle. Body 1028 enables a paint brush to be formed without a ferrule since body 1028 simultaneously holds filaments 1024 and spacers 1025 together and provides a structure that is attachable to a brush handle such as in an internal cavity of a brush handle. By eliminating the need for a ferrule, plug 1016 reduces the number of parts required to form a paint brush, reduces assembly time and reduces the overall cost. In addition, because plug 1016 is preferably solid, plug 1016 lacks internal cavities or voids where paint or other fluid may enter. More importantly, plug 1016 may be pre-manufactured independently using forming system 1010 and stored for later assembly wherein plug 1016 is simply inserted into a handle such as any of handles 112, 412 or 612. In addition, body 1028 of plug 1016 may be provided with various thicknesses while supporting differently dimensioned groups of bristles for use with system 810 in lieu of cartridge 815. Furthermore, body 1028 of plug 1016 may alternatively be provided with an opening 930 into which an end of a handle may be inserted similar to that shown in Figure 17.

**[0107]** Figures 19-21 illustrate the formation of a paintbrush 1110 using brush forming system 1210 which

includes mold 1214 having mold halves 1216, 1218 which receive plug 1016. Halves 1216, 1218 each include lower plug engaging blades or edges 1220 which penetrate into plug 1016 as shown in Figures 20 and 21 to seal against plug 1016. Alternatively, edges 1220 may extend into a corresponding groove preformed into an exterior surface of body 1028 of plug 1016 to seal against plug 1016. In yet another alternative embodiment, the plug may be provided with a raised surface around its perimeter, wherein the mold halves clamp down upon the raised surface to "crush" this zone to provide a secure shut-off for the mold. Halves 1216, 1218 define a cavity 1215 which extends above and partially about sides of plug 1016 adjacent to locking structure 1032.

**[0108]** As shown by Figures 19-21, brush 1010 is formed by first bringing mold halves 1216, 1218 together about plug 1016 such that edges 1220 penetrate body 1028 to seal against body 1028. An insert 1015 is positioned above body 1028 within cavity 1215. Afterwards, a handle material, such as PETA, polyethylene, polypropylene or other polymeric material is injected into cavity 1215 through injection port 1224. The fluid material flows into cavity 1215 around and about body 1028 to a point just above edges 1220. The material also flows upward throughout the remainder of mold halves 1216, 1218 to form the remainder of the paint brush handle which has a head portion and a shank portion similar to those head portions and shank portions described above and as defined by the internal surfaces of mold halves 1216, 1218. After the material injected through port 1224 has cooled and/or solidified to form handle 1112 which is molded about plug 1016, both halves 1216, 1218 may be separated, leaving brush 1110.

**[0109]** Insert 1015 may be an insert of lightweight foam material or may be an insert of rigid strong material depending upon the desired characteristics of paint brush 1010. Moreover, insert 1015 may alternatively be omitted, wherein the material injected into cavity 1015 at about body 1028 of plug 1016 forms the entirety of the remainder of brush 1110 which is substantially solid (not hollow). In a further alternative embodiment, the material injected through port 1224 about body 1028 may comprise a soft compressible elastomeric material that is resistant to most solvents commonly used in painting applications such as SANTOPRENE. In such an alternative embodiment, the elastomer encapsulates both body 1028 of plug 1016 and insert 1015. The resulting brush is rigid in strength due to the rigidity of plug, 1016 and insert 1015 but is comfortable to grip due to the compressibility and rubber-like characteristics of the material injected about insert 1015 and body 1028.

**[0110]** In the exemplary embodiment, the material injected through port 1224 and partially encapsulating body 1028 of plug 1016 envelops locking structures 1030 and 1032 of body 1028 to mechanically interlock plug 1016 with the remainder of the paint brush handle 1112. Such a mechanical interlock is extremely impor-

tant where bonding of plug 1016 to the remainder of handle 1112 may be difficult due to the incompatibility of the materials chosen. In alternative applications where body 1028 of plug 1016 and remainder of handle 1112 are compatible such that the two may be joined together by heat fusion or welding or where both materials may be adhesively bonded to one another, locking structures 1030 and 1032 may be omitted,

**[0111]** Figures 22 and 23 illustrate brush forming system 1310 used to form brush 1110 in a continuous fashion. System 1310 generally includes filament and spacer guide and feed 1312, plug mold 1314 and brush mold 1316. Filament and spacer guide and feed 1312 feeds and guides a clustered group of filaments 1024 and spacers 1025 into plug mold 1314. Movement of filaments 1024 and spacers 1025 through guide 1312 into plug mold 1314 may be assisted by gravity or other conventionally known transfer mechanisms and methods.

**[0112]** Plug mold 1314 generally includes side walls 1318 having injection port 1320 and door 1322. Once filaments 1024 and spacers 1025 have been partially deposited into cavity 1324 defined by wall 1318 and door 1322, plug body material is injected into cavity 1324 through port 1320 at least partially about filaments 1024 and spacers 1025 to bond and retain filaments 1024 and spacers 1025 together and to form body 1028 of plug 1016. Once the material forming body 1028 has sufficiently solidified and hardened, door 1322 is opened (as shown in Figure 23) and the completed plug is transferred into handle forming mold 1316. Meanwhile, an additional clustered group of filaments 1024 and 1025 is transferred through guide 1312 into the now open plug cavity 1314 for manufacture of a successive brush.

**[0113]** Brush forming mold 1316 is substantially similar to mold 1214 except that mold 1316 includes edges 1320 which actuate between a plug disengaged position (shown in Figure 22) and a plug engaged position (shown in Figure 23). In the plug disengaged position shown in Figure 22, plug 1016 is permitted to be transferred into mold 1316. Once plug 1016 has been deposited into mold 1316, edges 1320 are actuate to a plug engaging position in which edges 1320 partially penetrate into plug 1016 to seal cavity 1315. Afterwards, the paint brush handle material is injected through port 1324 into cavity 1315 to partially encapsulate plug 1016 and to form the remainder of handle 1112 including head portion 1120 and a shank portion (not shown). In alternative embodiments, the material forming the remainder of handle 1112 may be blown into cavity 1315, with or without vacuum assist, such that the resulting handle extending about plug 1016 would be hollow or at least partially hollow. Once the brush handle material has been allowed to solidify, mold halves 1328, 1330 as well as edges 1320 are retracted and the completed brush 1110 is removed, allowing the next successive completed plug 1016 to be directed into handle forming mold 1316

for formation of a successive paint brush 1110.

**[0114]** Figure 24 illustrates paint brush forming system 1410, an alternative embodiment of forming system 1310 for continuously forming paint brushes 1110. System 1410 is similar to system 1310 except that system 1410 includes plug forming mold 1414 in lieu of plug forming mold 1314. Plug forming mold 1414 includes mold halves 1418, 1419 which pivot about axes 1420 between a plug forming position (shown in solid lines) and a plug release position (shown in phantom). In the plug forming position, halves 1418, 1419 form cavity 1424 which extends about ends of filaments 1024 and about interleaved spacers 1025. Plug forming material is then injected through port 1420 into cavity 1424 to form body 1028 and to complete plug 1016. After the material has sufficiently solidified, halves 1418 and 1419 are then pivoted by an actuator (not shown) to the plug releasing position, allowing the completed plug 1016 to be transferred into handle forming mold 1316 for completion of paint brush 1110 as set forth above with respect to Figure 23.

**[0115]** Figures 25 and 26 illustrate paint brush forming system 1410 for forming brush 1110. System 1410 generally includes mold 1414 having halves 1418, 1419 which join together to form plug cavity 1421 and handle cavity 1423. Upon separation from one another, halves 1418 and 1419 release a completed brush. As shown by Figure 25, each half 1418, 1419 includes a plug forming portion 1426 and a handle forming portion 1428. Plug forming portion 1426 and handle forming portion 1428 are integrally formed as a single integral mold half. Mold 1414 further includes at least one injection port communicating with both cavities 421, 423. In the exemplary embodiment, plug forming portion 1426 includes injection port 1430 and handle forming portion 1428 includes injection port 1432 through which material is injected into mold 1414. Alternatively, mold 1414 may be provided with a single injection port for injecting material into both of cavities 1421 and 1423.

**[0116]** To form brush 1110, bristle filaments 1024 are clustered with interleaved spacers 1025. Halves 1418 and 1419 are then converged together so as to position plug forming portion 26 of each of halves 1418, 1419 adjacent to and partially about bristle filaments 1024 and spacers 1025. Plug forming material is then injected through port 1430. The plug forming material bonds bristle filaments 1024 and spacers 1025 together and forms body 1028 of plug 1016. Once the plug forming material has sufficiently solidified, mold halves 1418, 1419 are repositioned as shown in Figure 26 to position handle forming portions 1428 opposite to the formed plug 1016. Such repositioning can be achieved by either linearly moving mold halves 1418, 1419 downward in the direction indicated by arrows 1436 or by first withdrawing mold halves 1418, 1419 away from plug 1016, lowering halves 1418, 1419 in the direction indicated by arrows 1436 and then once again bringing halves 1418, 1419 together about plug 1016. Once positioned as shown in

Figure 26, handle forming material is injected through port 1432 to form handle 1112. As will be appreciated, in lieu of handle 1112 being solid as shown in Figure 26, handle 1112 may alternatively include an insert such as 1015 which has different characteristics than the handle forming material. As discussed above, the plug forming material preferably comprises a material compatible with material forming bristle filaments 1024 to form an adequate bond with filaments 1024. The plug forming material is also preferably compatible with the handle forming material. In the exemplary embodiment, the plug forming material comprises polypropylene with a tie-layer such as BYNEL manufactured and sold by DuPont. In such a case, the handle forming material comprises polypropylene. In alternative embodiments, the plug forming material may comprise polyethyleneterephthalate (PET), polypropylene or other polymeric materials which are resistant to paint solvents. The handle forming material may comprise similar materials.

[0117] In lieu of plug forming portion 1426 being integrally formed with handle forming portion 1428, plug forming portion 1426 may alternatively comprise a distinct member moveable relative to handle forming portion 1428 such that only plug forming portion 1426 of halves 1418, 1419 is moved in the direction indicated by arrows 1436 after plug 1016 has been formed. In such an alternative embodiment, plug forming portions 1426 are positioned within the lower ends of handle forming portions 1428 during the formation of plug 1016 as described above. Once plug 1016 has been completed, plug forming portions 1426 are lowered to a point just below the lower ends of handle forming portions 1428. Thereafter, the handle forming material is injected into cavity 1423 to form handle 1112. A schematic illustration of this alternative brush forming system 1510 is illustrated in Figures 27 and 28,

[0118] Figures 29 and 30 illustrate brush forming system 1610 for forming brush 1110. Brush forming system 1610 is similar to brush forming system 1510 except that brush forming system 1610 includes plug forming portions 1626 in lieu of plug forming portions 1426. Plug forming portions 1626 are substantially identical to plug forming portions 1426 except that plug forming portions 1626 pivot about axes 1640 between a plug forming position shown in Figure 29 and a handle forming position shown in Figure 30. In the plug forming position, plug forming portions 1626 extend in close contact with filaments 1024 and spacers 1025. As shown in Figure 28, in the plug forming position, plug forming portions 1626 define cavity 1621 such that cavity 1621 is radially inset relative to cavity 1623 formed by handle forming portions 1628 of mold halves 1418, 1419. When plug forming portions 1426 are in the plug forming position shown in Figure 28, plug material is injected into cavity 1621 through port 1630 to form plug 1016.

[0119] Once the plug forming material has sufficiently solidified to complete the formation of plug 1016, plug forming portions 1626 are pivoted away from one an-

other about axes 1640 as shown in Figure 30 to the handle forming position. Thereafter, handle forming material is injected through port 1632 into cavity 1623 and into the space between plug forming portions 1626 and plug 1016 to form handle 1112. As will be appreciated, in lieu of plug forming material and the handle forming material being injected through separate ports, such materials may alternatively be injected into the mold through a single port in each of systems 1410, 1510 and 1610. Overall, each of systems 1410, 1510 and 1610 enable brush 1110 to be easily manufactured in a continuous fashion.

## **V. FERRULE-BRISTLE SUBASSEMBLY, HANDLE-BRISTLE ASSEMBLY AND METHODS OF MANUFACTURE**

[0120] Figures 31 and 32 illustrate a method for manufacturing ferrule-bristle subassembly 1717. Subassembly 1717 generally includes ferrule 1716, bristle filaments 1024 and spacers 1725. Ferrule 1716 is substantially identical to ferrule 116 shown in Figures 4 and 5 such that ferrule 1716 may be positioned within an interior cavity of a brush handle. Alternatively, ferrule 1716 may be configured similar to ferrule 16, wherein ferrule 1716 is configured to be positioned over an axial end of a brush handle. Ferrule 1716 is preferably formed from a plastic. Alternatively, ferrule 1716 may be formed from a metal.

[0121] Spacers 1725, like spacers 1025, are interleaved or positioned between bristle filaments 1024 proximate an axial end of ferrule 1716. Spacers 1725 are at least partially formed from a thermoplastic material. Preferably, the thermoplastic material forming spacers 1725 is sufficiently compatible with material forming filaments 1024 to form a reliable bond therebetween. The material of spacers 1725 may comprise a thermoplastic foam material, such as polypropylene foam, which upon melting solidifies and bonds to filaments 1024.

[0122] As shown in Figure 31, subassembly 1717 is formed by first positioning filaments 1024 and spacers 1725 within an axial end of ferrule 1716. This can be achieved by first pulling filaments 1024 through ferrule 1716, inserting spacers 1725 and pulling filaments 1024 and the interleaved spacers 1725 back through ferrule 1716 such that spacers 1725 wedge filaments 1024 against ferrule 1716. As shown in Figure 31, spacers 1725 each include a wedge portion 1727 which extends between filaments 1024 and a melting portion 1729 which extends above and beyond filaments 1024. In the exemplary embodiment, portions 1727 and 1729 are integrally formed as a single unitary body of the same material. Alternatively, portions 1727 and 1729 may be formed from different materials wherein portion 1729 is made of a thermoplastic material and wherein portion 1727 provides the optimal wedging of filaments 1024 against ferrule 1716. As shown by Figure 32, melting portions 1729 are then heated such that portions 1729

melt to at least a partially liquid state so as to penetrate and bond to filaments 1024 and to also bond to interior surfaces of ferrule 1716. In the exemplary embodiment, interior surface of ferrule 1716 includes detents or grooves 1731 and 1733 into which the fluid material flows and forms a mechanical interlock with ferrule 1716 upon solidifying. The resulting subassembly eliminates the need for an additional epoxy or other adhesive to bond the filaments and the spacers together and to the ferrule. Moreover, the resulting subassembly 1717 produces a stronger bond between the spacers and the ferrule since the spacers themselves serve as the adhesive. As a result, subassembly 1717 is easier to manufacture at a lower cost.

**[0123]** In an alternative embodiment, filaments 1024 and spacers 1725 are directly inserted into an internal cavity formed within an axial end of a brush handle to form a handle-bristle assembly, whereby melting portion 1729 of the spacers is heated to bond the filaments together and to also bond to the interior surfaces of the paint brush handle. Heating of melting portions 1729 may be achieved using flame heating, laser heating, infrared heating, hot air heating or hot iron heating.

**[0124]** Figures 33 and 34 illustrate a method for manufacturing subassembly 1817. Subassembly 1817 generally includes ferrule 1716, filaments 1824 and spacers 1025. Ferrule 1716 and spacers 1025 are described above. Bristle filaments 1824 are generally formed from a thermoplastic material and include paint carrying portion 1827 and melting portion 1829 extending above and beyond spacers 1025. In the exemplary embodiment, portions 1827 and 1829 are formed from the same material such as nylon, polyester, polyolefin or a blend thereof. Alternatively, paint carrying portion 1827 and melting portion 1829 may be formed from different blends of materials wherein only melting portion 1829 is required to be formed from a thermoplastic material.

**[0125]** As best shown by Figure 33, subassembly 1817 is constructed by positioning filaments 1824 and spacers 1025 within ferrule 1716 such that melting portions 1829 extend above and beyond spacers 1025. According to an exemplary method, filaments 1824 are pulled through ferrule 1716, spacers 1025 are inserted or interleaved between and among filaments 1824, and filaments 1824 are pulled back through ferrule 1716 until spacers 1025 wedge filaments 1824 against ferrule 1716 with melting portions 1829 of filaments 1824 extending above spacers 1025. As shown in Figure 34, melting portions 1829 of filaments 1824 are then heated to a temperature above the melting point of melting portions 1829 such that melting portions 1829 of filaments 1824 melt at least partially about spacers 1025 to join filaments 1824 to spacers 1825 and to further join both filaments 1824 and spacers 1025 to ferrule 1716. According to a preferred method, the melted material of melting portions 1829 of filaments 1824 flows into and against locking surfaces 1731 and 1733 of ferrule 1716 to mechanically interlock with ferrule 1716,

**[0126]** Moreover, in lieu of bristles 1824 and spacers 1025 being bonded to ferrule 1716 which is then secured to a brush handle, filaments 1824 and spacers 1025 may alternatively be directly inserted into an interior cavity of a brush handle having an interior surface similar to ferrule 1716, wherein the axial ends of the filaments 1824 are melted to bond to spacers 1025 and to further secure filaments 1824 and spacers 1025 to the brush handle to form a handle-bristle assembly. According to yet another alternative embodiment, both the bristle filaments and spacers include a thermoplastic melting portion, such that upon being heated, melt and fuse together to join the filaments and the spacers and to secure the spacers and the filaments to a ferrule such as ferrule 1716. In such an alternative embodiment where both the brush filaments and the spacers have at least a thermoplastic portion which is melted, the filaments and spacers may be directly inserted into an interior cavity of a brush handle and then melted while positioned within the interior cavity to form a bond between the filaments and the spacers and to also form a bond to the interior surface of the brush handle cavity.

## **VI. PAINT BRUSH FORMING SYSTEM WITH BREAK-AWAY FERRULE**

**[0127]** Figure 35 illustrates paint brush forming system 1910 for forming paint brushes 1950, 1952. Paint brushes 1950 and 1952 include handles 1953, 1954 and ferrule-bristle subassemblies 1955, 1956, respectively. Handles 1953, 1954, portions of which are shown in section for purposes of illustration, are substantially identical to one another and include shank portions 1958, 1960 and head portions 1962, 1964, respectively. Shank portions 1958, 1960 are substantially identical to one another. Head portion 1962 has a general length L1 longer than the length L2 of head portion 1964. Ferrule-bristle subassemblies 1955, 1956 are identical to one another prior to assembly of paint brushes 1950 and 1952. In particular, each of subassemblies 1955, 1956 includes bristle filaments 1024 and spacers 1025 (not shown) which are positioned within and secured to ferrule 1916. Filaments 1024 and spacers 1025 may be secured to ferrule 1916 by epoxy or by either of the methods disclosed with respect to Figures 31-34. Ferrule 1916 receives bristles 1024 and spacers 1025 and is configured to be inserted into interior cavity 1970 of head portion 1962 of brush 1950. Ferrule 1916 preferably includes outwardly extending ribs 1920 which correspond to grooves 1922 formed on an inner surface of head portion 1962 of brush 1950. During assembly of brush 1950, ferrule 1916 is inserted into cavity 1970 such that ribs 1920 project into grooves 1922 to mechanically lock ferrule 1916 to head portion 1962 of brush handle 1953.

**[0128]** Ferrule 1916 also includes an internal groove 1930 preferably extending between ribs 1920. Groove 1930 sufficiently penetrates the walls of ferrule 1916 so



as to serve as a break line allowing ferrule 1916 to be broken along groove 1930. As a result, portion 1932 of ferrule 1916 may be discarded leaving portion 1934 sized for being completely received within cavity 1972 of head portion 1964 of brush handle 1954. Although ferrule 1916 is illustrated as including a single break line or groove 1930, ferrule 1916 may be provided with a plurality of such grooves enabling ferrule 1916 and the bristles 1024 it carries to be easily adapted and modified for use with a multitude of different brush handles having differently sized head portions to form a multitude of differently sized paint brushes. Break line or groove 1930 may alternatively be external or partially internal and partially external. Break line or groove 1930 enables differently sized brushes to be quickly and easily manufactured and assembled without requiring a specially sized ferrule for each differently sized brush handle.

[0129] Figures 1-35 illustrate multiple paint brushes and multiple methods for manufacturing such paint brushes. Although such methods and such paint brushes are illustrated and discussed with respect to the particular exemplary embodiments chosen, it is also contemplated that the disclosed paint brushes may be formed by other methods described above with respect to other paint brush embodiments. For example, although plug 1016 is illustrated in Figures 19-21 as being provided with handle 1112, plug 1016 may alternatively be utilized with handle 12 illustrated in Figure 1. Furthermore, the above disclosed manufacturing methods may be combined or particular manufacturing steps may be rearranged or replaced by other manufacturing procedures described above to vary the resulting paint brush being formed.

## Claims

1. A plurality of paint applicators comprising;

a first applicator including:

a first handle having an exterior configuration; and  
a first paint applying medium coupled to the first handle, the first paint applying medium having a first medium configuration with a first width and a first thickness; and

a second applicator including:

a second handle having the same exterior configuration; and  
a second paint applying medium coupled to the second handle, the second paint applying medium having a second medium configuration having a second width and a second thickness different than the first width and the first thickness, respectively.

2. The paint applicators of claim 1, wherein the first handle has a first interior cavity having a first interior configuration receiving the first paint applying medium, and wherein the second handle has a second internal cavity having a second internal configuration different from the first internal configuration and receiving the second paint applying medium.

3. The applicators of claim 2, wherein the second internal configuration includes at least one projection.

4. The applicators of claim 3, wherein the second internal configuration includes a plurality of projections arranged so as to reduce an effective internal dimension of the second internal cavity.

5. The applicators of claim 2, wherein the first handle has a first head thickness extending between the exterior configuration of the first handle and the first interior cavity and wherein the second handle has a second thickness extending between the exterior configuration of the second handle and the second internal cavity, wherein the second thickness is different than the first thickness.

6. The applicators of claim 1, wherein the first paint applying medium is coupled to a first mounting portion having a first configuration and wherein the second paint applying medium is coupled to a second mounting portion having a second configuration different than the first configuration.

7. The applicators of claim 6, wherein the first handle and the second handle include internal cavities having same internal cavity configurations and wherein the internal cavities of the first and second handles receive the first and second mounting portions, respectively.

8. The applicators of claim 6, wherein the first mounting portion and the second mounting portion include similarly configured openings that receive portions of the first and second handles, respectively.

9. The paint applicators of claim 6, wherein the first mounting portion and the second mounting portion comprise ferrules.

10. A plurality of paint applicators comprising:

a first applicator including:

a first handle having an exterior configuration and a first interior cavity having a first interior configuration; and  
a first paint applying medium coupled to the first handle, the first paint applying medium having a first medium configuration; and

a second applicator including:

a second handle having the same exterior configuration and a second interior cavity having a second interior configuration different than the first interior configuration; and  
a second paint applying medium coupled to the second handle, the second paint applying medium having a second medium configuration different than the first medium configuration.

11. The paint applicators of claim 10, wherein the second interior configuration includes at least one projection extending into the second internal cavity so as to reduce an effective size of the second internal cavity.

12. The applicators of claim 10, wherein the first handle has a first head thickness between the exterior configuration and the first interior cavity and wherein the second handle has a second thickness extending between the exterior configuration and the second internal cavity, wherein the second thickness is different than the first thickness,

13. A plurality of paint applicators comprising:

a first applicator including:

a first handle having an exterior configuration; and  
a first paint applying medium having a first configuration and being coupled to a first mounting portion, the first mounting portion having a first sized dimension; and

a second applicator including:

a second handle having the same exterior configuration; and  
a second paint applying medium having a second configuration and being coupled to a second mounting portion, the second mounting portion having a second sized dimension different from the first sized dimension.

14. The paint applicators of claim 13, wherein the first handle and the second handle include interior cavities which at least partially receive the first mounting portion and the second mounting portion, respectively.

15. The paint applicators of claim 13, wherein the first mounting portion and the second mounting portion include first and second openings, respectively,

wherein the first and second openings are similarly configured and wherein the first and second openings receive the first handle and the second handle, respectively.

16. The paint applicators of claim 13, wherein the first mounting portion and the second mounting portion comprise ferrules.

17. A paint applicator comprising:

a handle having an internal cavity including at least one inwardly extending projection; at least one paint applying medium; and a mounting portion coupled to the at least one paint applying medium, the mounting portion received within the interior cavity, wherein the at least one projection engages the mounting portion.

18. The paint applicator of claim 17, wherein the applicator has a greater longitudinal length and wherein the at least one projection extends along a longitudinal axis.

19. A method for forming a plurality of distinct paint applicators having a common exterior head configuration and distinct paint applying medium configurations, the method comprising:

forming a plurality of handles, each handle including a head having an exterior configuration, an interior having a mouth, and a head thickness therebetween;

forming a plurality of paint carrying units, each unit including at least one paint applying medium coupled to a mounting portion and disposed within an interior of one of the plurality of handles, the mounting portion having a mounting portion exterior configuration and a mounting portion thickness between the mounting portion exterior configuration and the paint applying medium; and

varying a configuration of the paint applying medium while varying at least one of the head thickness and the mounting portion thickness to form a plurality of distinct paint applicators having a common exterior head configuration and distinct paint applying medium configurations.

20. The method of claim 19 including the step of varying the head thickness.

21. The method of claim 20 including:

providing a mold having an internal cavity configured to form a handle having an exterior con-

figuration;  
 inserting one of a plurality of differently sized inserts into the cavity, wherein the inserts are configured to form the interior; and  
 supplying handle forming material between the mold and the insert, wherein the differently sized inserts vary the head thickness to allow the head to accommodate variously configured paint applying mediums.

22. The method of claim 21, wherein at least one of the plurality of differently configured inserts is configured to form at least one projection extending into the interior of the handle.

23. The method of claim 22, wherein at least one of the plurality of differently configured inserts is configured to form at least one projection extending into the interior of the handle along a major longitudinal axis.

24. The method of claim 19 including the step of varying the mounting portion thickness.

25. The method of claim 19, wherein the paint applying medium comprises a plurality of bristles.

26. A paint applicator comprising:

a paint applying medium; and  
 a handle coupled to the paint applying medium, the handle comprising:

a first portion;  
 a second portion coupled to the first portion along a junction, wherein the first and second portions extend opposite one another to form the handle; and  
 an elastomeric layer sealing the junction between the first portion and the second portion.

27. The applicator of claim 26, wherein the elastomeric layer forms a seal over the junction.

28. The applicator of claim 26, wherein the elastomeric layer forms a seal between the junction.

29. The applicator of claim 26 including a hinge between the first portion and the second portion.

30. The applicator of claim 29, wherein the hinge is integrally formed as part of a single unitary body with the first portion and the second portion.

31. A method for forming a paint applicator handle, the method comprising:

providing a mold;  
 positioning a preform into an interior of the mold, the preform having a head portion forming a cavity with a mouth and a shank portion;  
 heating and expanding the shank portion against the mold; and  
 removing the formed handle from the mold.

32. A bristle cartridge comprising:

a plurality of bristle filaments arranged into a cluster;  
 at least one spacer within the cluster; and  
 a polymeric material coupling the bristle filaments and the at least one spacer together, wherein the polymeric material forms a body configured to be received within a paint applicator handle.

33. The cartridge of claim 32, wherein the polymeric material includes a tie layer.

34. A method for forming a paint applicator, the method comprising:

providing a bristle cartridge including a plurality of bristle filaments arranged into a cluster;  
 at least one spacer within the cluster and a polymeric material coupling the bristle filaments and the at least one spacer together; and  
 encapsulating the bristle cartridge with material that forms a handle.

35. A method for forming a bristle cartridge, the method comprising:

providing a plurality of bristle filaments arranged into a cluster having an end;  
 positioning at least one spacer within the cluster proximate the end; and  
 at least partially melting one of the at least one spacer and the plurality of bristles to join the at least one spacer and the plurality of bristles.

FIG. 1

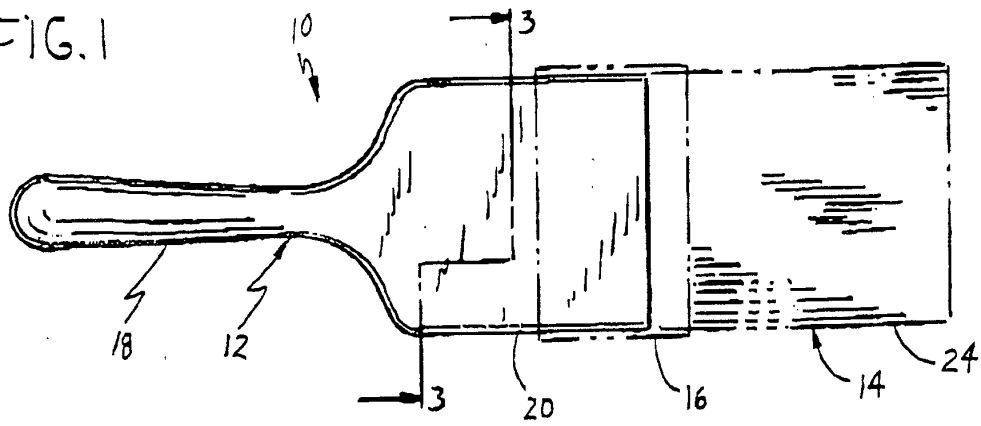


FIG. 2

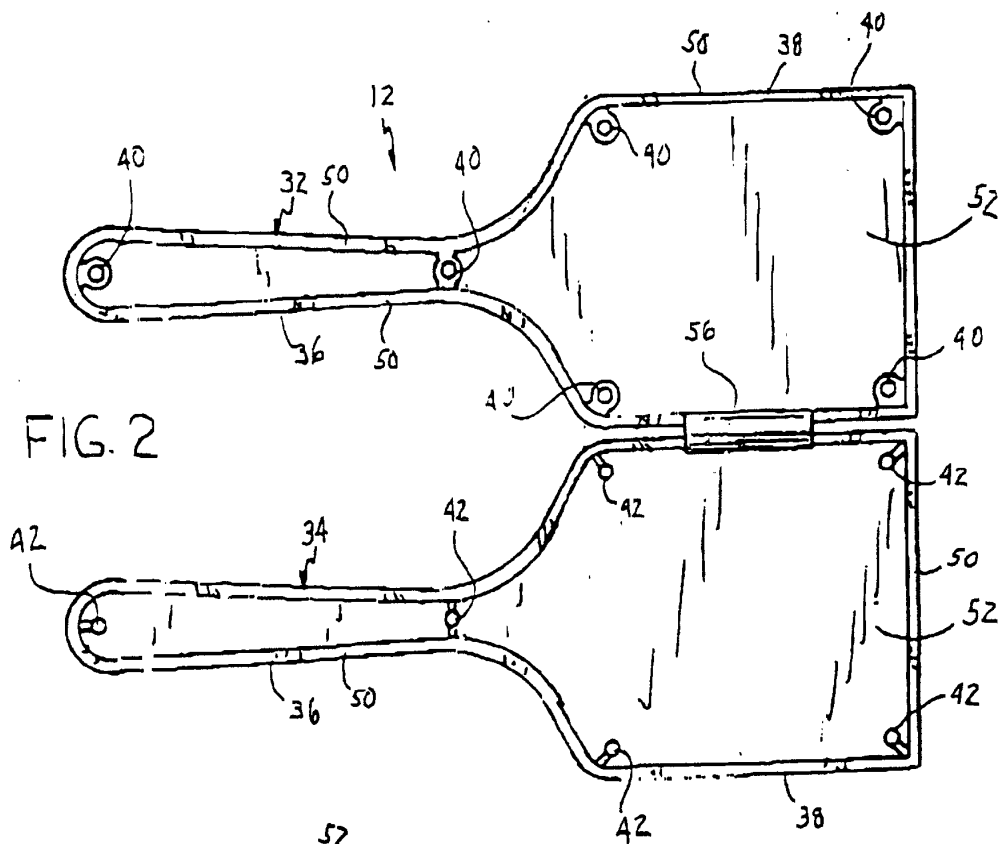
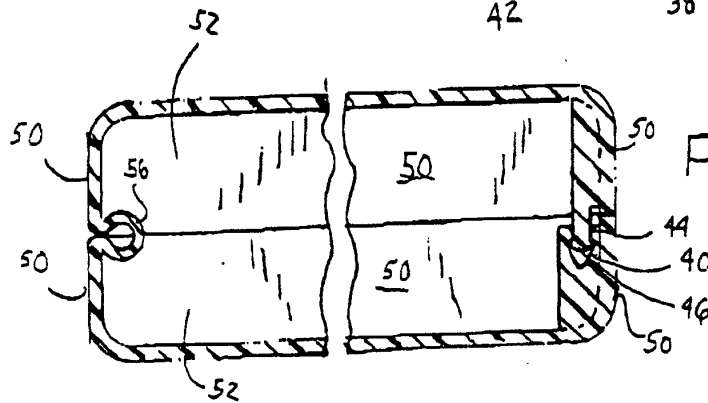
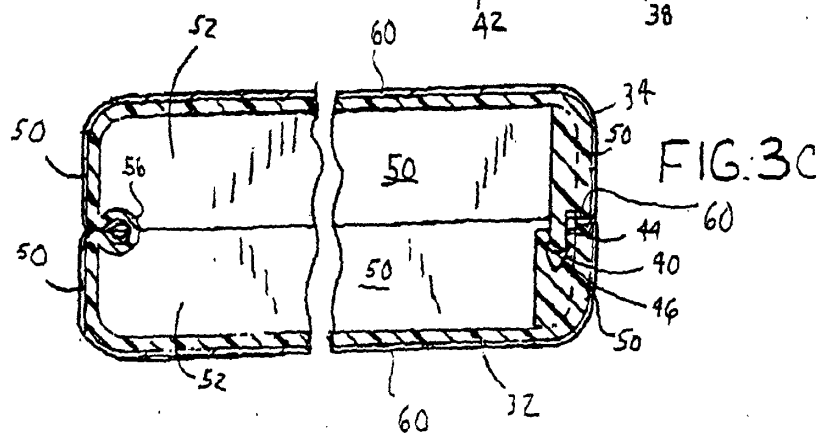
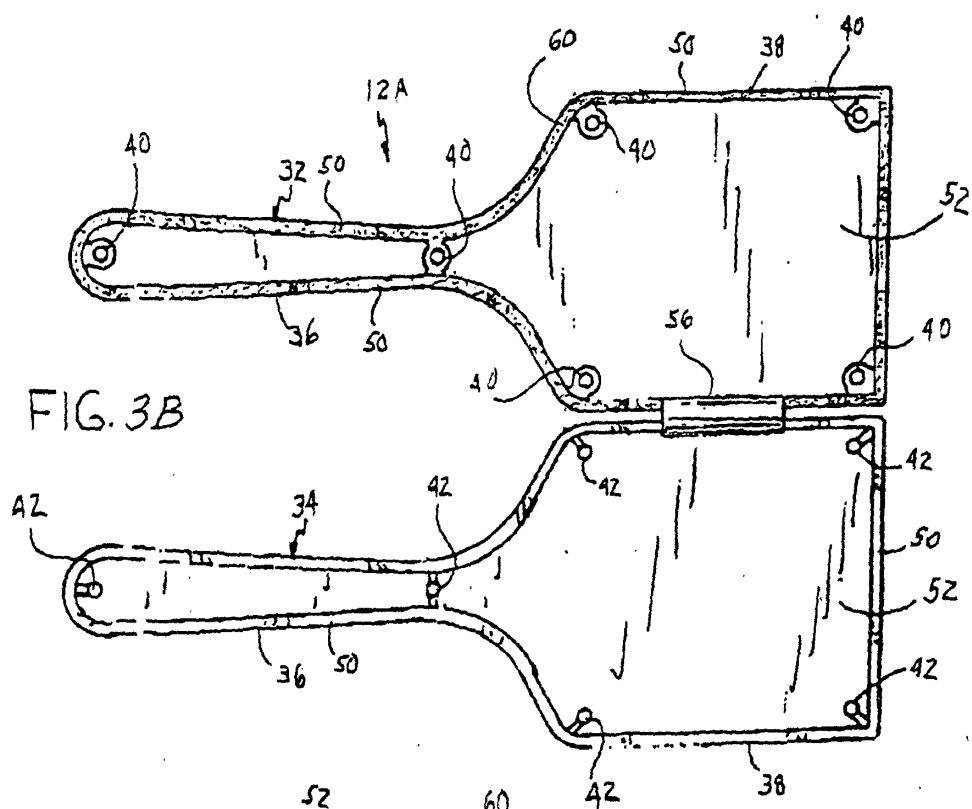
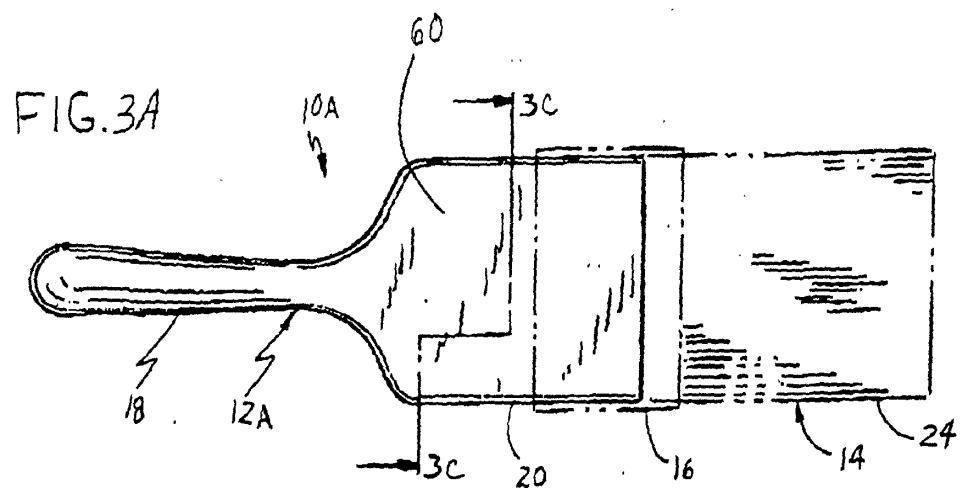
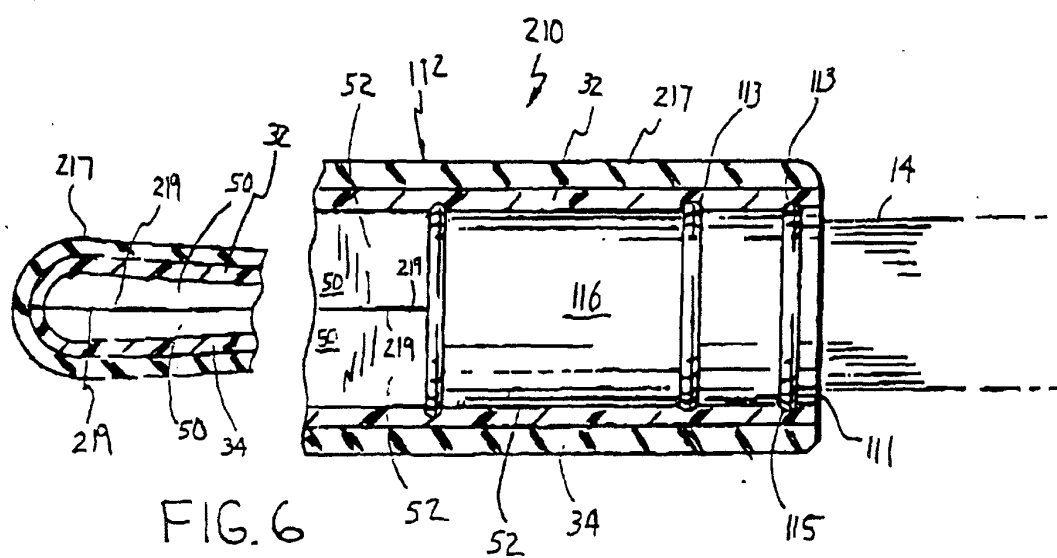
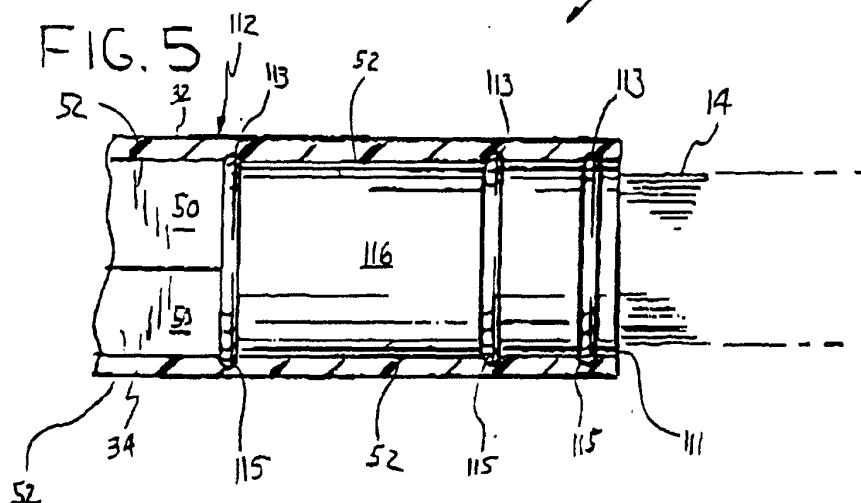
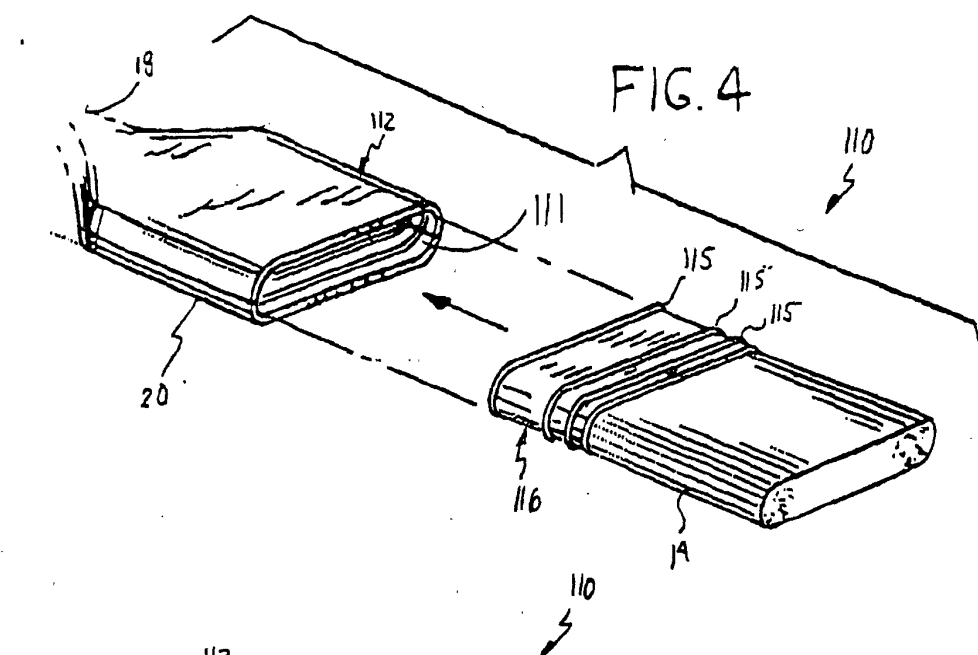
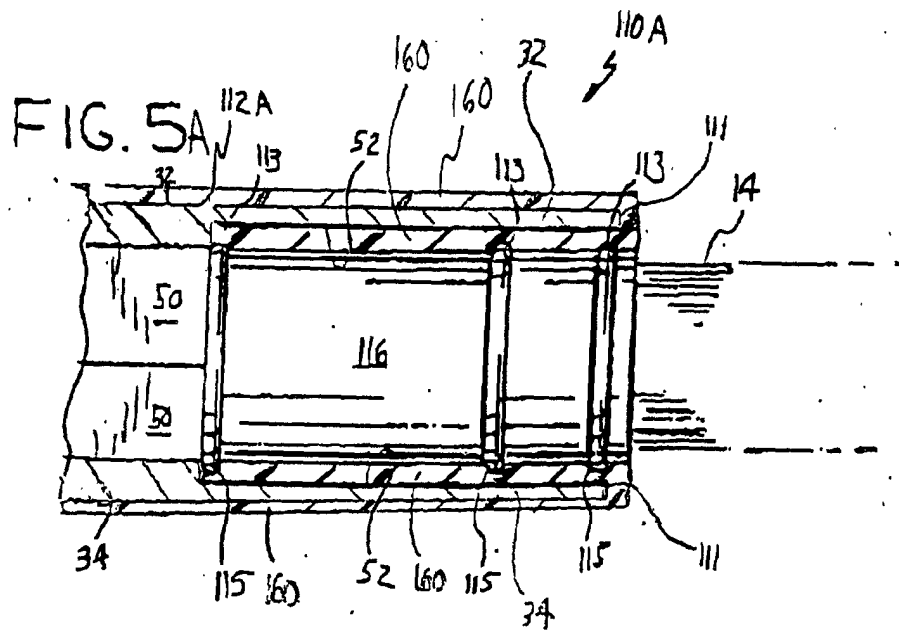


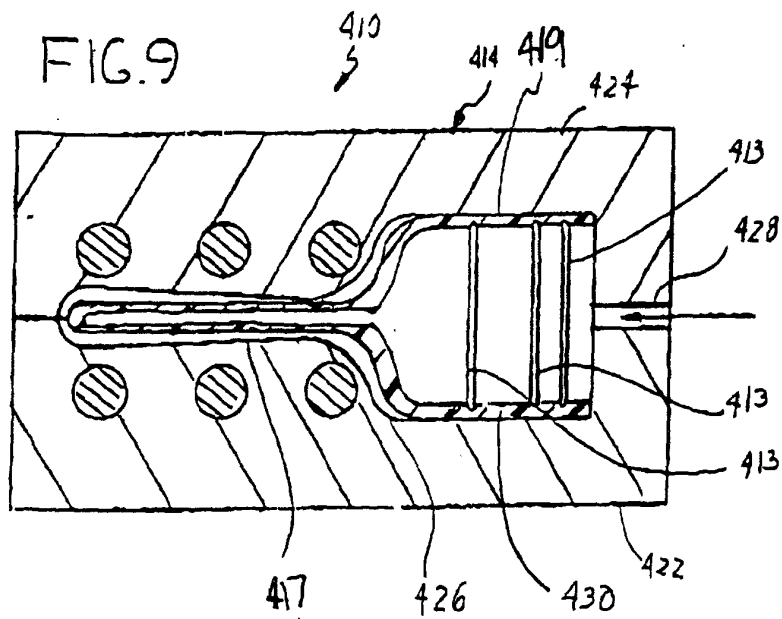
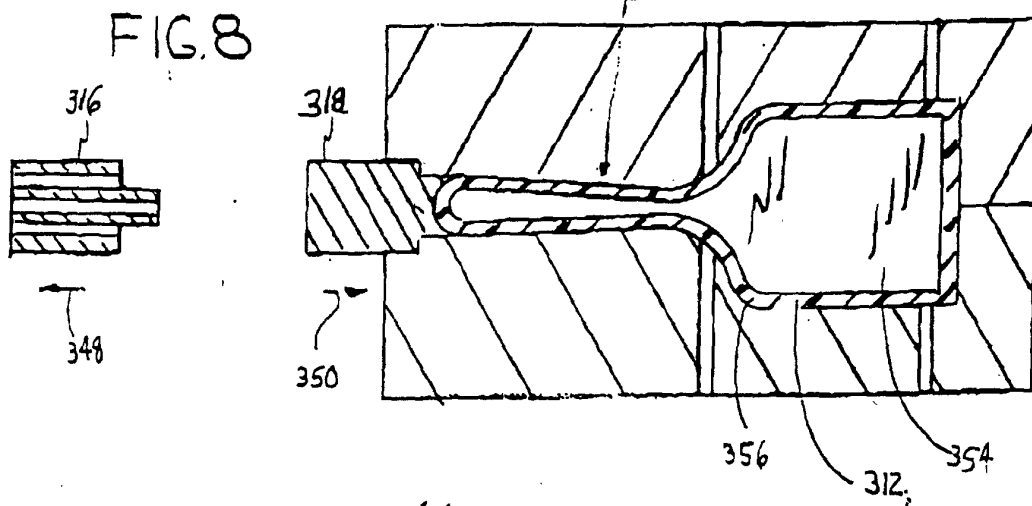
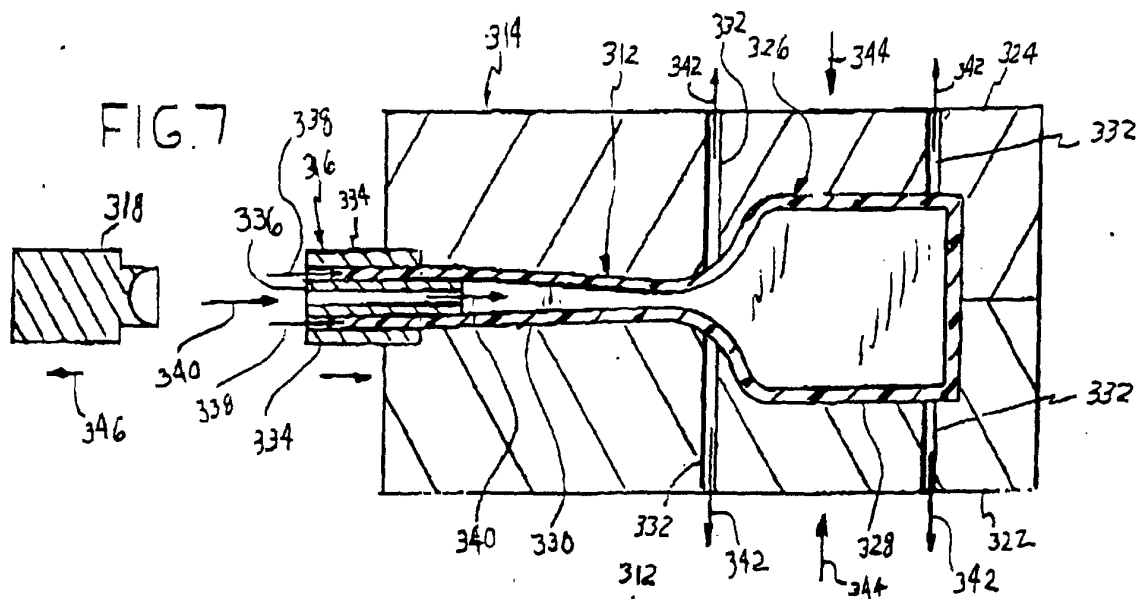
FIG. 3



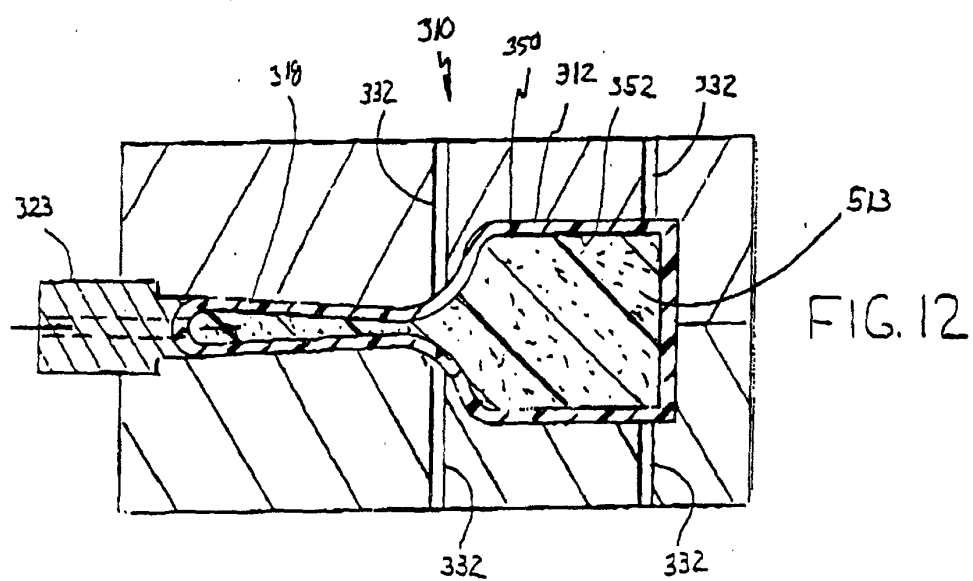
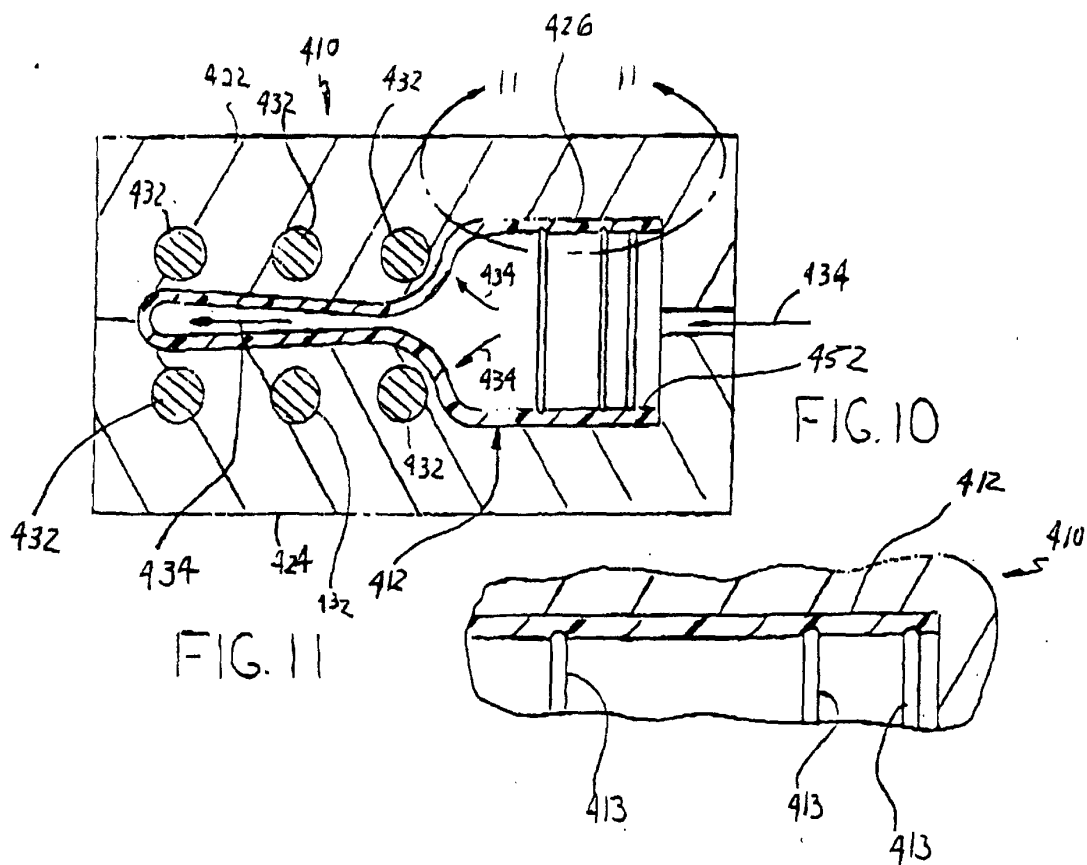


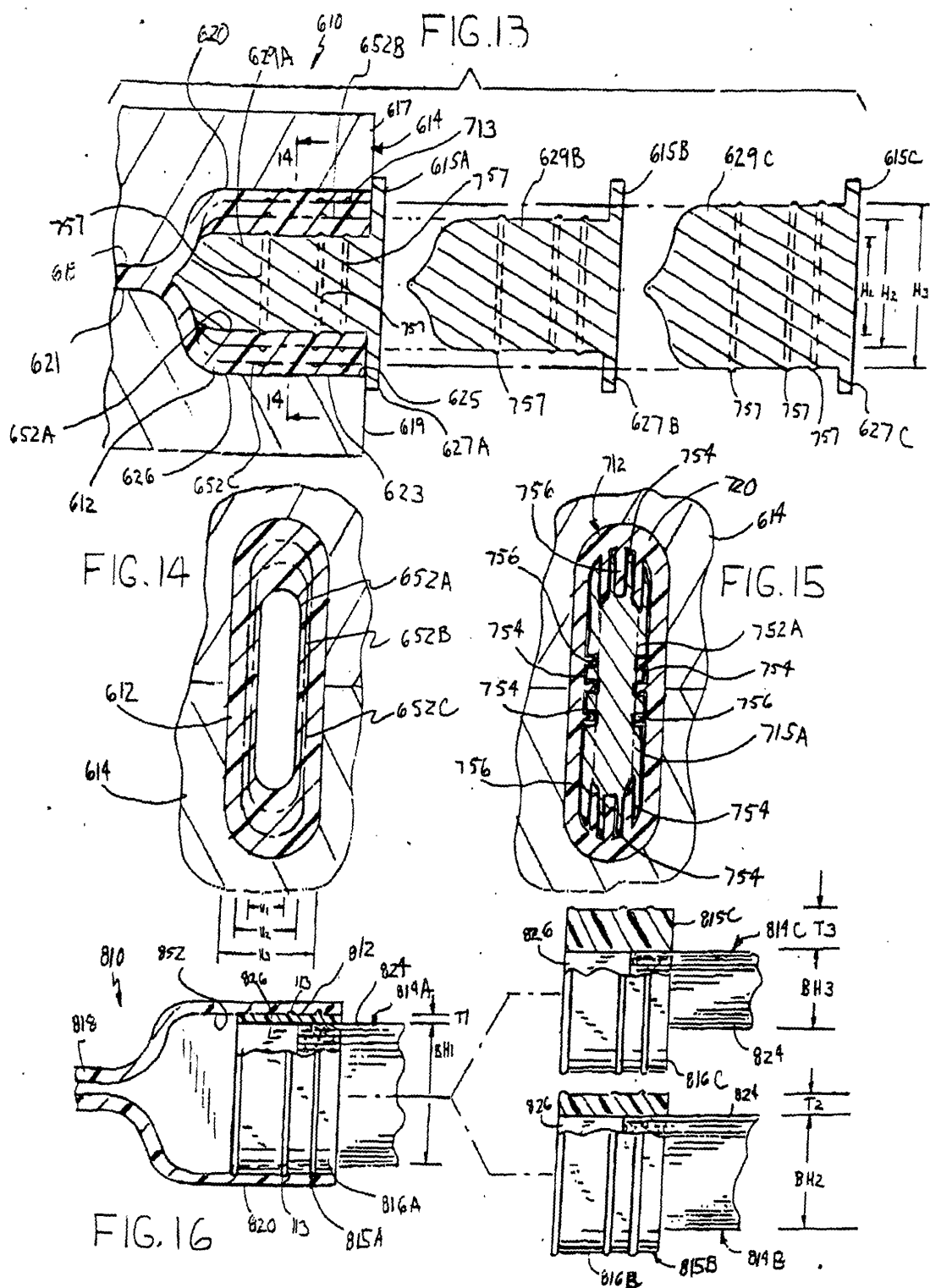


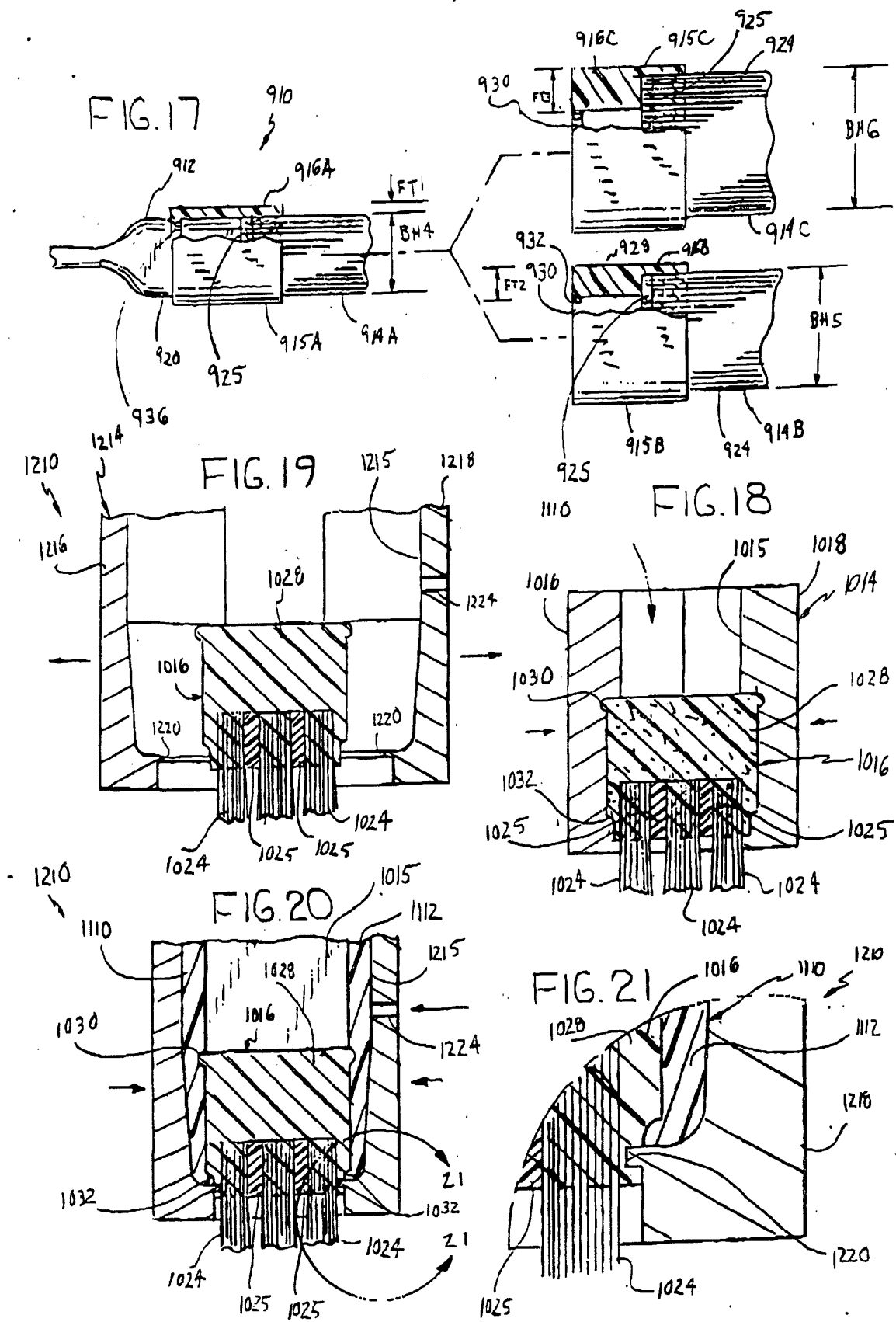


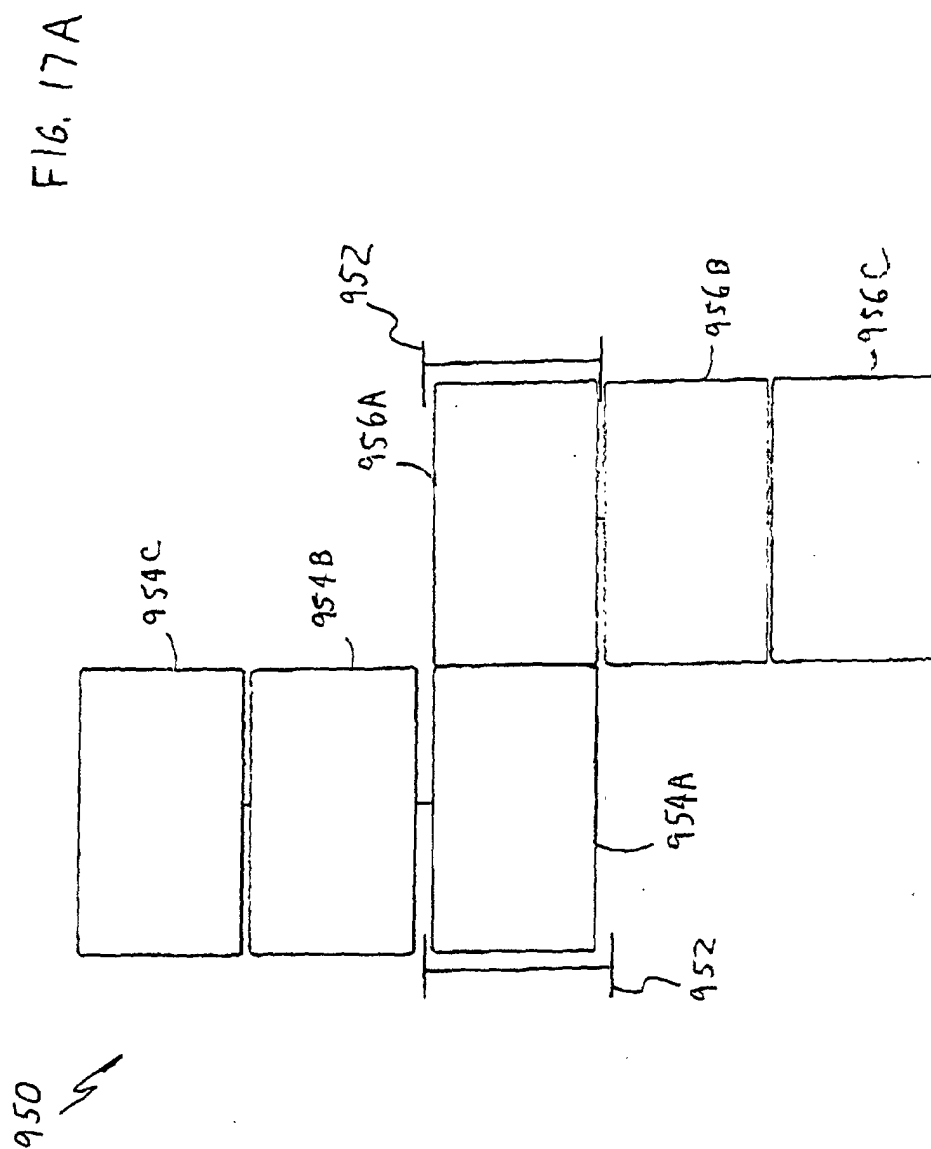












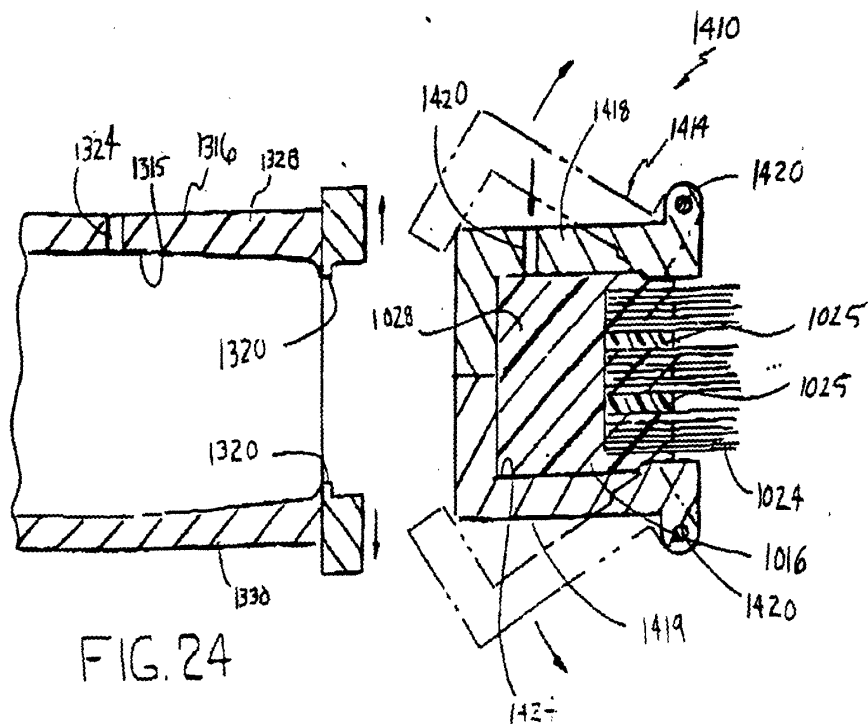
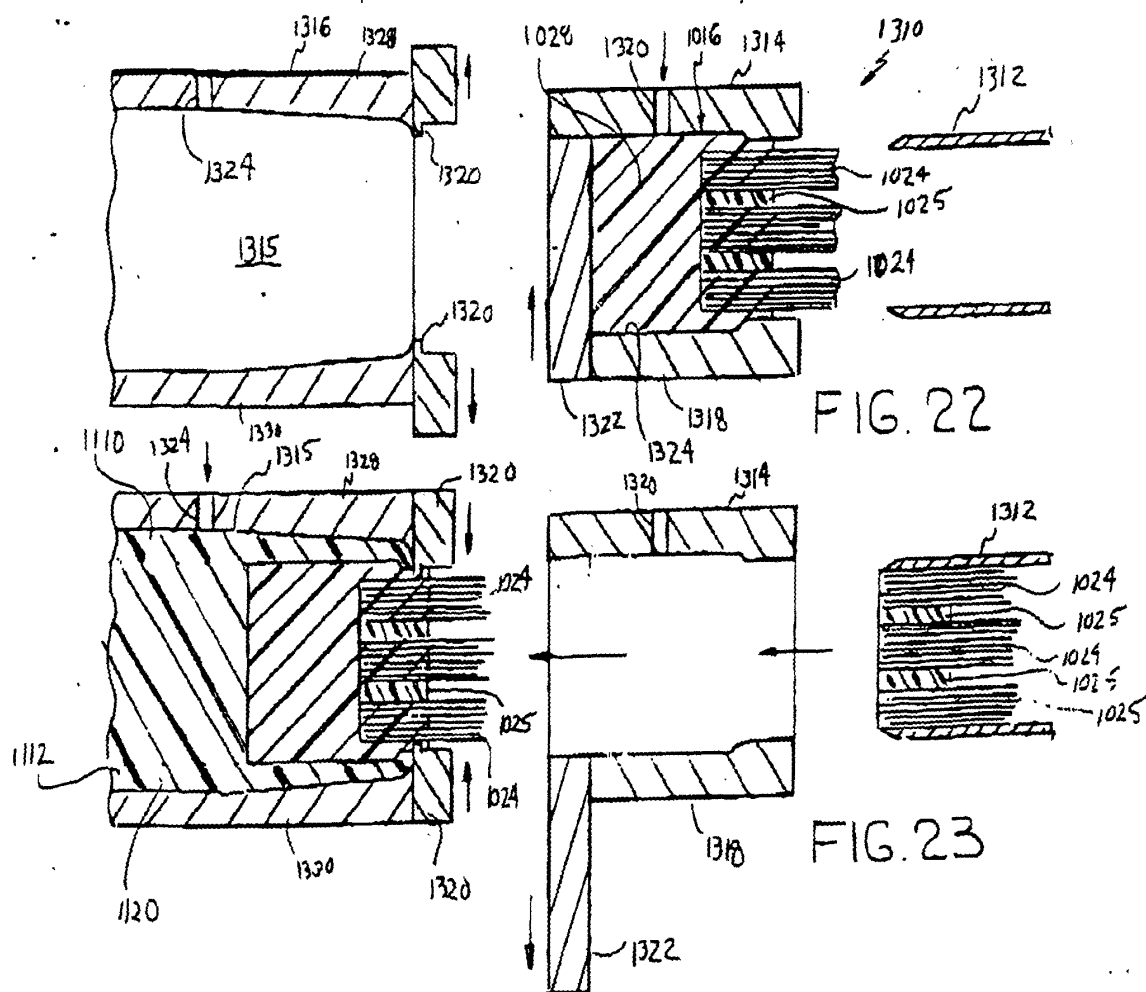


FIG. 25

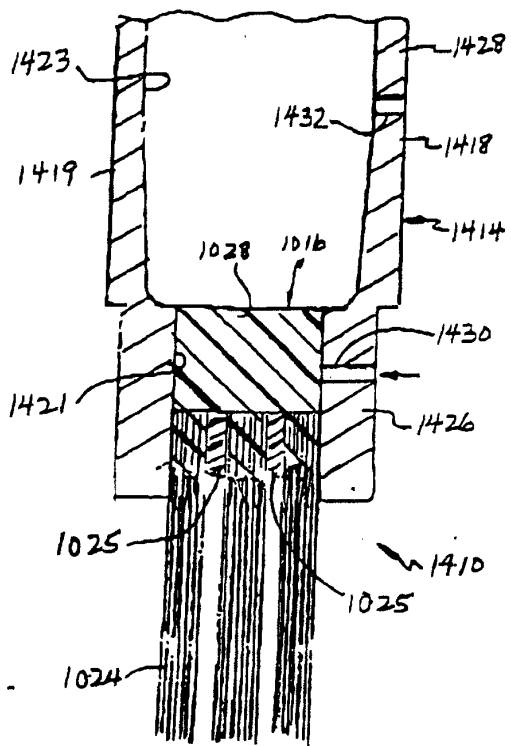


FIG. 26

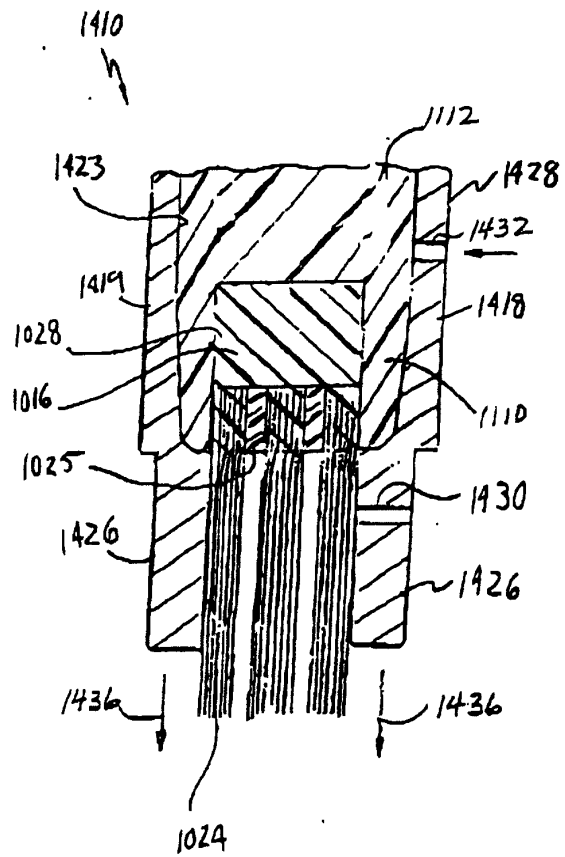


FIG. 27

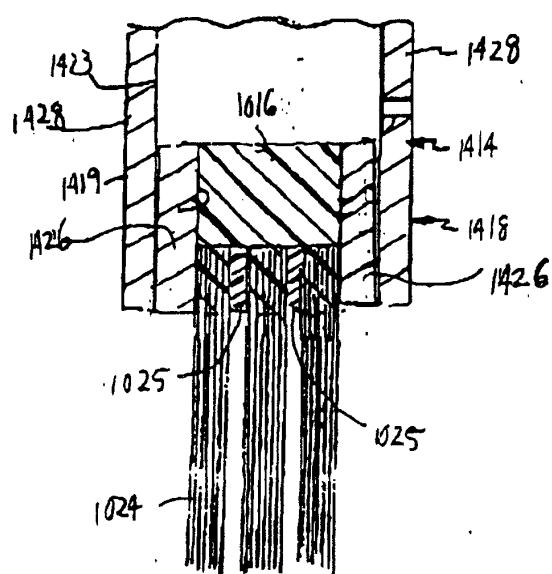


FIG. 28

