

April 8, 1952

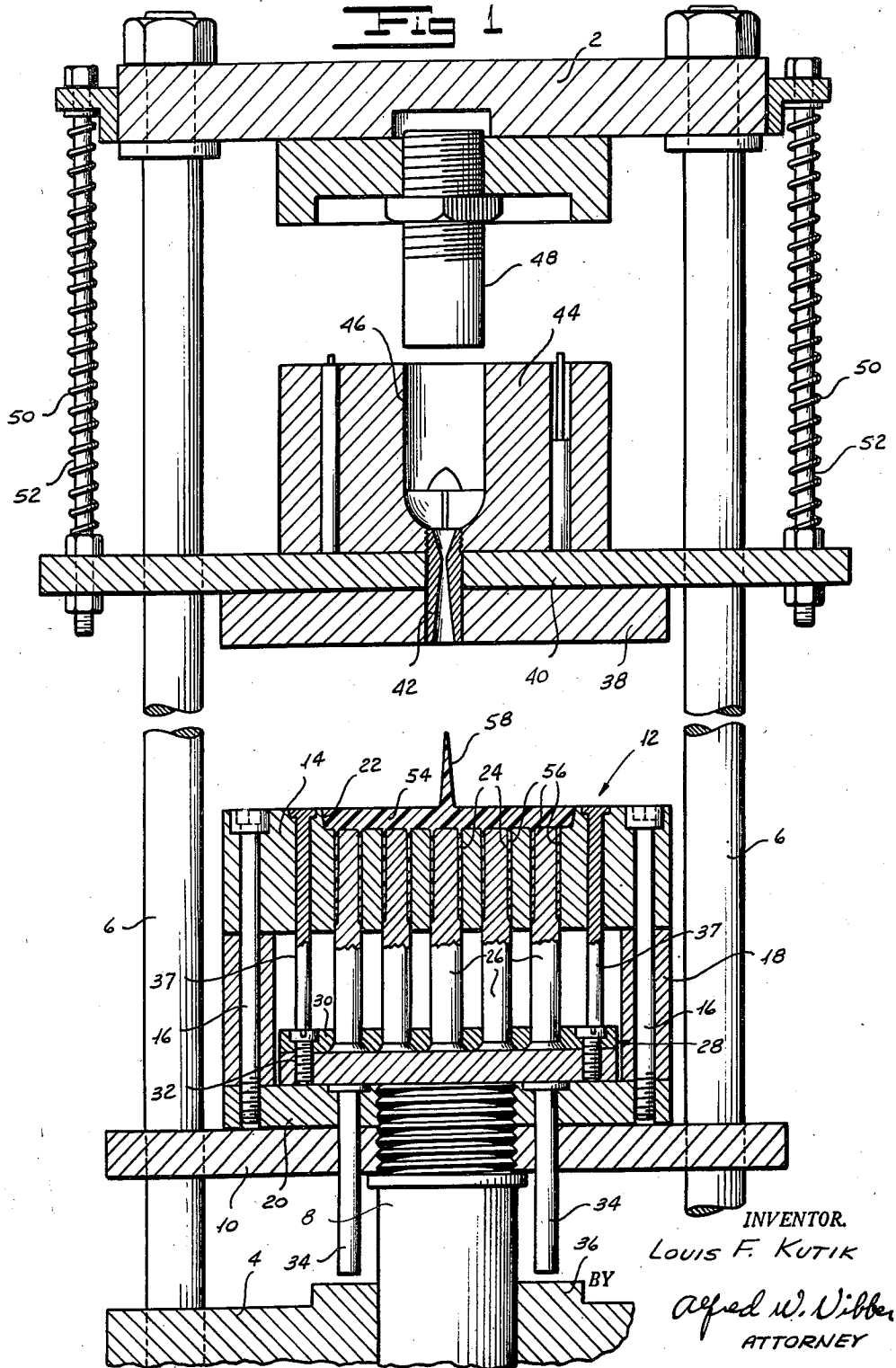
L. F. KUTIK

2,592,296

METHOD OF AND APPARATUS FOR MAKING BRUSHES

Filed April 1, 1950

3 Sheets-Sheet 1



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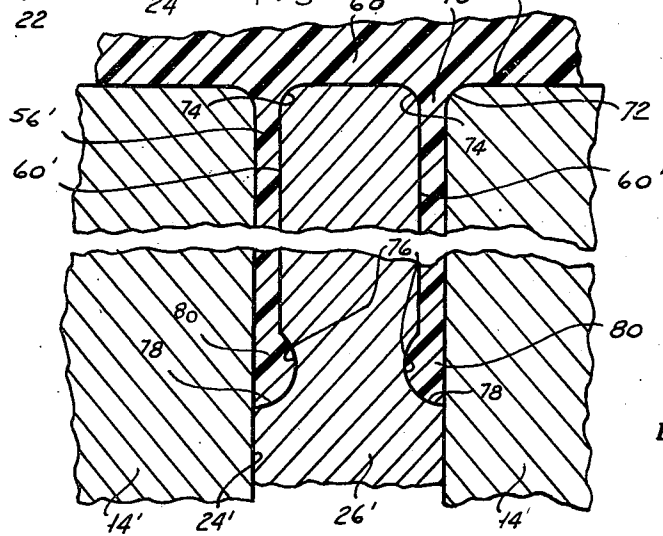
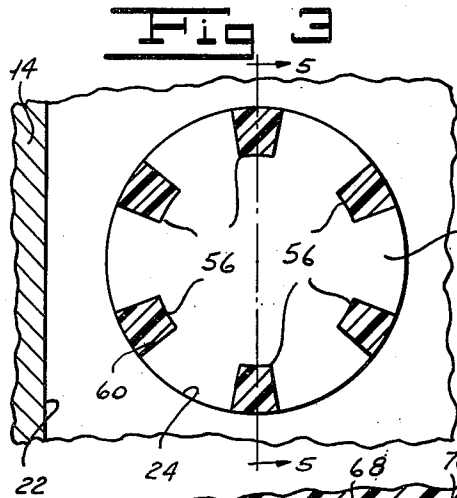
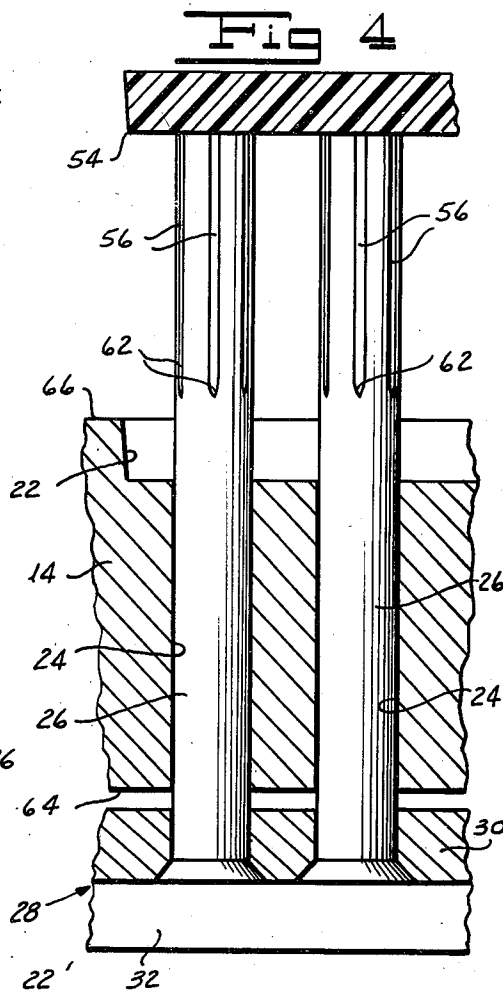
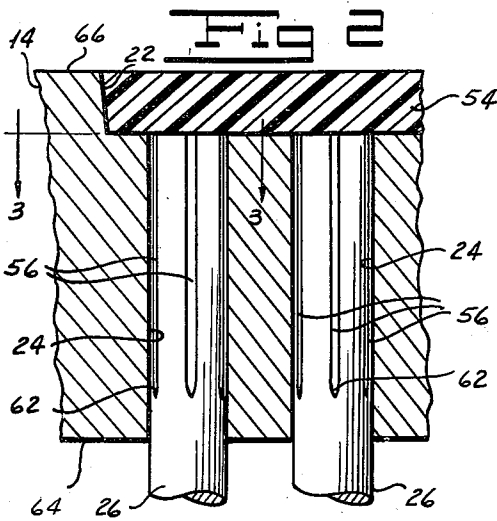
L. F. KUTIK

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METHOD OF AND APPARATUS FOR MAKING BRUSHES

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3 Sheets-Sheet 2



INVENTOR.
LOUIS F. KUTIK

BY

Alfred W. Vibber
ATTORNEY

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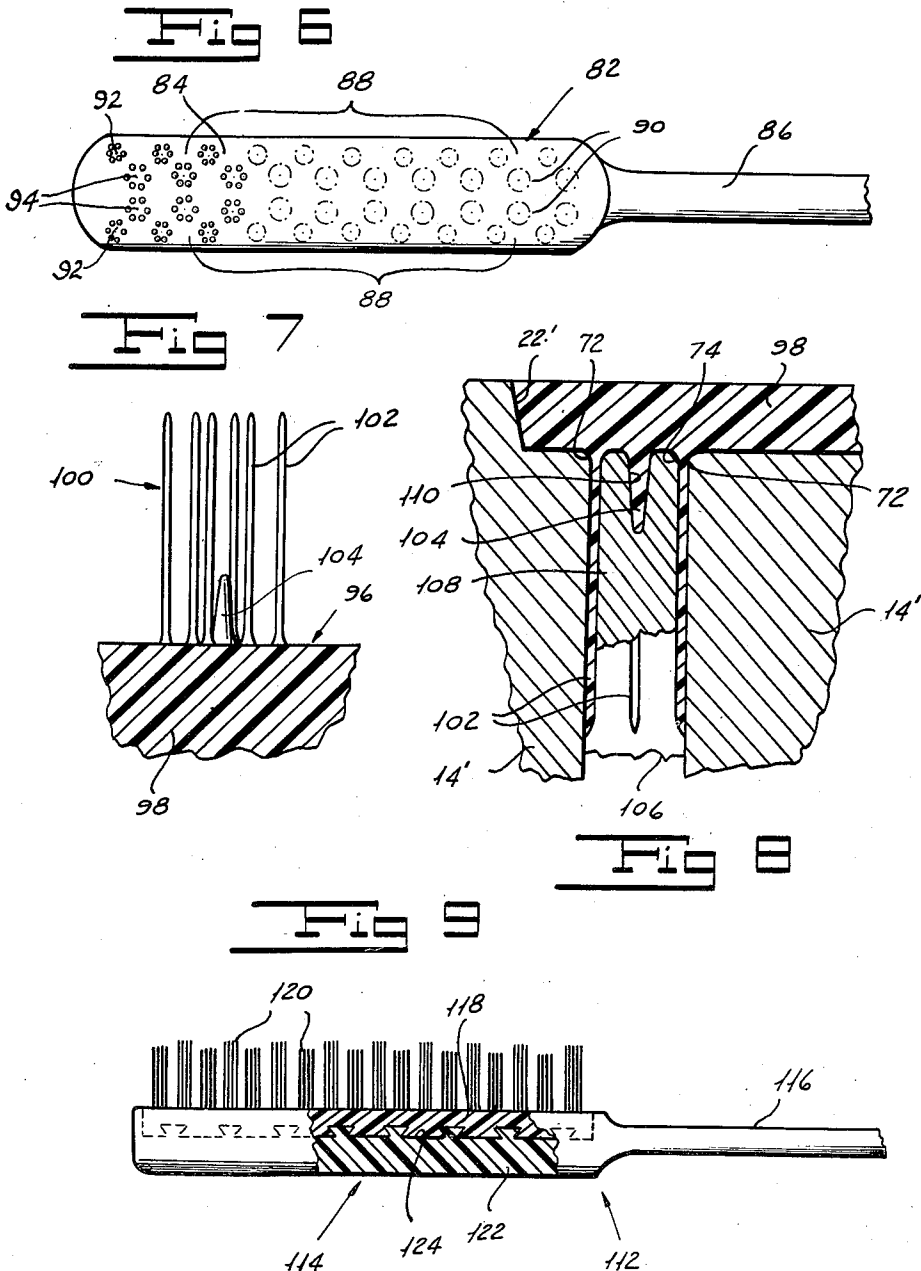
L. F. KUTIK

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METHOD OF AND APPARATUS FOR MAKING BRUSHES

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3 Sheets-Sheet 3



INVENTOR.
LOUIS F. KUTIK
BY
Alfred W. Nibbel
ATTORNEY

UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR
MAKING BRUSHES

Louis F. Kutik, Fair Lawn, N. J.

Application April 1, 1950, Serial No. 153,428

9 Claims. (Cl. 18-42)

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This invention relates to an improved method of, and to apparatus for making brushes. The brush made by the method and apparatus of the invention is characterized by having its bristles integral with the backing element or member, the bristles having desired predetermined characteristics and locations with respect to such backing element. The method of the invention is characterized by its simplicity and by the speed with which it may be practiced. The apparatus of the invention is simple, rugged, and is characterized by its ease of operation, both in the molding of the brushes or brush parts and in the extraction of the molded brushes or brush parts from the mold. A further distinguishing feature of the molding apparatus of the invention lies in the ease with which it is adapted to and mounted upon a standard injection molding press.

In the prior art, brushes such as tooth brushes, clothes brushes, and the like, have in general been made by two processes:

(1) The brush backing member has been drilled, tufts of bristles have been inserted in such drilled openings, and the tufts have been cemented or otherwise secured in place in such openings.

(2) Bristle tufts have been formed and have been held, commonly by templates in the desired orientation. The brush backing member has then been formed by being molded in contact with the lower ends of such bristle tufts, thereby bonding the tufts to the brush backing.

Method (1) above has been slow, expensive and tedious, as can be readily appreciated from the fact that each tuft of bristles had to be placed in the drilled openings in the brush backing by hand. In method (2) above, the bond between the bristles and the brush backing has very often proved to be faulty, because of the chilling effect exercised on the injected plastic forming the brush backing element by the bristle ends, by the lack of time to allow full permeation of such plastic into the bristle tufts and thus into contact with each bristle, and by the lack of effective bonding between the bristles which the plastic material does contact and the brush backing plastic material.

It has been proposed to form brushes, in which the bristles and the backing member are integral, by means of an injection molding process. However, in such proposed method the necessary mold is complicated, the bristles thus formed are necessarily few, such bristles are not optimally placed, and the ends of the bristles re-

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note from the brush backing element must be cut, and are thus not molded to shape. Further such mold requires complicated operating mechanism, so that it is not readily adapted for mounting in a standard molding press.

It is accordingly among the objects of the invention to provide an improved forming method for brushes of the indicated character, such method being simple and speedy to operate. Such method yields uniformly similar brushes or brush parts of the type in which the bristles and at least the backing element thereof immediately adjacent the bristles are integral.

A still further object of the invention resides in the provision of a simple, economical, and rugged apparatus for the making of brushes or brush parts and for the practicing of the above method. The apparatus of the invention is particularly characterized by its ease of adaptation to use in a standard injection molding machine.

These and further objects of the invention will be more readily apparent upon consideration of the following description of preferred embodiments of the methods of making brushes and of the apparatus made in accordance with the invention for forming such brush and for performing such method. In the drawings accompanying the specification, and forming a part thereof:

Fig. 1 is a general view, partly in elevation and partly in section generally axially of the injection molding plunger, of an injection molding machine in accordance with the invention, such view being taken in the vicinity of the brush-making mold of the invention;

Fig. 2 is an enlarged view in section, such section being taken along the axis of the bristle-forming, retractable, pins of the mold shown in Fig. 1, the pins being shown in elevation;

Fig. 3 is a still further enlarged view in transverse section through a bristle forming pin of the mold, the section being taken along the line 3-3 in Fig. 2;

Fig. 4 is a fragmentary view, similar to Fig. 2, of the mold pins and the pin retaining plate of the mold, the pins and plate being shown in the position which they assume after they have thrust the molded article from the mold;

Fig. 5 is an enlarged view in axial section through a second illustrative embodiment of a bristle forming pin of the mold of the invention, such pin forming bristles having fillets at the juncture of the bristles with the backing member and further forming bristles having an en-

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largement at their outer ends, the section being taken along the line located in the same position as line 5—5 in Fig. 3;

Fig. 6 is a view in plan of a typical brush made by use of apparatus in accordance with the invention, the brush having bristles of different characteristics located in different predetermined locations on the backing element or member;

Fig. 7 is a fragmentary view in side elevation of a further embodiment of a brush made by use of apparatus in accordance with the invention, such brush incorporating, in each tuft-like group of bristles, a deflection limiting member or bristle located centrally of the other bristles in the tuft-like group;

Fig. 8 is a fragmentary view, in section axially of the bristle-forming pin of the mold, of the mold of the injection molding apparatus for forming the brush structure shown in Fig. 7; and

Fig. 9 is a fragmentary view, partially in side elevation and partially in vertical section, through a still further embodiment of the brush made by apparatus of the invention, the bristles and the portion of the backing member adjacent the bristles being made integral, and the major part of the backing member, including the handle, being made of a different plastic material, such major part of the backing member being bonded to the bristle holding portion of such backing member.

In Fig. 1 there is shown a portion of a conventional injection molding machine for plastic materials, such machine incorporating a mold in accordance with the present invention. The molding machine there shown incorporates two relatively fixed heads or cross members 2 and 4, such members being held parallel with respect to each other by means of a plurality of tie and guide rods, of which two are shown at 6. Projecting centrally through head 4 is the piston rod 8 of a double-acting piston and cylinder arrangement (not shown) which positively reciprocates piston rod 8 in a vertical direction as the device is shown in Fig. 1. To the upper end of piston rod 8 there is secured, as shown, the ram head 10 which is guided upon guide rods 6. The main mold assembly, designated 12, is securely mounted upon and connected to ram head 10 so as to reciprocate therewith. Mold part 12 includes the top, mold cavity forming, mold plate 14, plate 14 being held to the bottom mold plate 20 by means of the studs 16. Such studs extend through the spacer member 18, as shown, to provide a substantial space between the bottom surface 64 of mold part 14 and the upper surface of bottom mold plate 20.

Mold plate 14 is provided in the upper surface thereof with a main cavity 22 which provides the space for the molding of the brush backing member. In this instance, cavity 22 is shown as being of a simple shape substantially rectangular in cross section. It is obvious that such cavity may be made of a variety of shapes, depending upon the desired size and configuration of the brush backing element or member. Extending vertically through mold member 14 into communication with cavity 22 is a plurality of spaced vertical circular cylindrical bores 24. Accurately fitting within, and vertically reciprocable with respect to, the bores 24 are a corresponding number of elongated pins 26 held at the bottom ends thereof in the pin retaining plate 28 consisting of the lower member 32 and the upper member 30 which are secured together as shown.

A plurality of angularly spaced pins 34 ver-

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tically reciprocable in bores in plates 10 and 20 are provided, as shown in Fig. 1. Pins 34 have their upper enlarged head portions bearing against the bottom surface of plate 32 when the mold parts are in the position shown in Fig. 1. Pins 34, which are conventional in injection molding machines, have the function of thrusting the pins 26 vertically with respect to mold part 14 when the piston 8 is retracted to its lowermost position, such pins 34 acting in the described manner when their lower ends contact the central portion 36 of fixed crosshead 4. The mold is also provided with a plurality of angularly spaced pin plate retracting pins 37, pins 37 being vertically reciprocable in bores in mold part 14, as shown. When the mold parts are in the partially retracted position shown in Fig. 1, the upper enlarged heads of pins 37 lie flush with the upper surface of mold part 14, and the lower ends of pins 37 are in contact with the upper surface of pin plate retaining member 30. Pins 37 are so positioned relative to the mold cavity that their upper ends contact the surface of the mold chase 38 at positions outwardly of the mold cavity closing portion of such mold chase when the pin plate 28 and thus pins 26 are in raised position relative to mold part 14 and when head 10 is advanced toward head 40.

The injection molding machine shown is further provided with a reciprocable cross head 40, such cross head bearing the injection nozzle 42. Also mounted on such cross head in communication with the injection nozzle is the injection pot structure 44, such structure having therein the plastic material receiving cavity 46. Mounted upon fixed cross head 2 in confronting relationship with the cavity 46 is the plunger 48. Cross head 40 is strongly thrust into the position shown in Fig. 1 by means of the compression springs 50 which, as shown, are positioned about the tie rods 52 which connect cross head 40 with cross head 2 and which limit travel of head 40 downwardly. It will be apparent that, when piston rod 8 is impelled vertically, the mold part 14 is thrust forcibly into contact with the mold chase 38 whereby a closed cavity is formed therebetween. Continued operation of piston rod 8 vertically effects entry of the extrusion plunger 48 into the cavity 46 of the injection pot 44 so that plastic material is forced through the injection nozzle 42 and into the mold cavity between the mold parts. In the position of the parts of the apparatus shown in Fig. 1, the brush assembly has been molded and the piston rod 8 has been partially retracted to open the mold cavity, retraction of the piston rod not having progressed to the point at which extraction of the molded part is begun. As is conventional in the art, both mold part 14 and mold chase 38 are preferably chambered and are supplied with temperature controlling fluid such as water or oil. For simplicity, neither the chambers in parts 14 and 38 nor the source of supply of temperature controlling fluid is shown.

The molded part formed by the described apparatus is, as indicated, a brush or brush part in which the backing element is integral with the bristles, both bristles and backing portion being formed in the same injection molding operation. The backing element of the brush is designated 54, and the bristles integrally connected thereto are designated 56. The sprue, formed by the nozzle 42, is designated 58. Such sprue, of course, is subsequently removed from the brush backing element.

In the preferred brush shown, the bristles 56 are placed or located on the bristle backing member of the brush in tuft-like groups or clumps. It has been found that for most brushing operations the tuft-like grouping of the bristles is preferable, both for efficiency of operation of the brush and for its subsequent cleansing. The bristles 56 are molded by the mold cavities formed between the bore 24 in the mold part 14 and the flutes 60 in each of pins 26, such flutes extending parallel to the axis of pin 26 and which are angularly spaced thereabout. In the embodiment shown, there are six such flutes equally spaced angularly about each of the pins 26, although it is obvious that a greater or less number may be employed, as desired. Each of flutes 60 has a bottom terminus designated 62, such bottom terminus lying above the bottom surface 64 of the mold part 14 when the upper ends of the pins 26 lie flush with the bottom surface of the brush backing element forming cavity 22 of the mold. Thus the bristle forming cavities in the mold are closed at their lower ends, and the bristles molded therein have their entire surfaces, including the ends thereof remote from the backing element, molded to final form. In the embodiment of the apparatus shown in Figs. 2 and 3, the flutes 60 cut into the pins 26 are generally rectangular in cross section, the sides of such flutes preferably lying on radii of the pin 26. It is apparent, however, that flutes 60 may if desired be varied in cross section, requirements of such flutes, and thus bristle sections, being that they have no re-entrant angles and further that the dimension of the bristle inwardly of the pins 26 shall not exceed the dimensions thereof at the outer surface of such pins. This, of course, is necessary to allow the easy removal of the molded bristles from the pins when the mold parts have reached the position shown in Fig. 4.

In Fig. 4 there is shown the position which the mold parts 14, 26, 30, and 32 assume relative to each other when the piston rod 8 has been retracted fully vertically, in which position pins 34 have thrust the pin retaining plate 28 so that the upper surface of plate 30 lies close to the lower surface 64 of mold part 14. In such position of the parts, the lower termini 62 of flutes 60 on pins 26 lie above the upper surface 66 of mold part 14. Such elevation of the pins 26, has, of course, carried with the pins the molded part consisting of the brush backing element 54 and the bristles 56 integral therewith. When the working portions of pins 26 and the molded article have been thus cleared of the mold part 14, the operator of the molding apparatus may remove the molded brush therefrom simply by a first motion generally axially of pins 26 and then a lateral withdrawal of the molded brush from the space between the separated die parts of the machine.

It will be seen that, as a consequence of such manner of forming of the brush backing element and the bristles integral therewith in accordance with the invention, it is possible easily considerably to vary the characteristics of and configurations of the bristles. Thus, in Fig. 5 there is shown a second embodiment of the apparatus, wherein the juncture between the brush backing and the bristles is filleted, thereby yielding added strength at such juncture, and the bristles have a knobbed or enlarged configuration at their outer ends, which in some instances, as in applicator brushes, may be desirable. In Fig. 5 the backing of the brush there formed is designated 68. Other portions of the mold and of the brush

which are similar to those previously described are designated by the same reference characters with an added prime.

The filleted portion 70 at the juncture between the backing 68 and the bristles 56' of the brush molded by the apparatus of Fig. 5 is formed by provision of the curved portion 72 at the upper end of the bores 24' in the mold portion 14', and by the curved upper ends of the pins 26', which as shown are provided with radiused portions 74 at their upper ends. In Fig. 5 there is shown the provision of bristles with knobbed lower ends, although it is understood that such feature need not be employed with the filleted juncture between bristles and backing element. As shown, pin 26' is provided adjacent the lower terminus 78 of the flute 60' with a partly spherical depression 76. Depression 76 provides a mold space for the forming of the lower terminus 80 of bristle 56', such terminus being in the shape of a knob. It is obvious that the bristles molded by the apparatus of Fig. 5 present no difficulty in extraction from the mold parts, since upon the thrusting vertically of pins 26' through the mold part 14', so that the flutes in the pins lie above such mold part in the manner shown in Fig. 4, bristles 56' may be readily removed from pins 26', because of the fact that the bristles are limber and will bend sufficiently to allow the relief of knobs 80 from depressions 76 in the pins upon withdrawal of the molded brush or brush part axially of pins 26'.

It will be appreciated that, in accordance with the present invention, it is a simple matter to provide a brush such as a tooth brush in which bristles of predetermined characteristics may be positioned in various locations on the backing element for the brush. Thus, in Fig. 6 there is shown a toothbrush generally designated 82, in which the two outer rows of bristles have different characteristics from the two inner rows of bristles. In such brush the backing element, generally designated 84, is integrally molded with the handle of the brush designated 86. The two outer rows 88 of bristles consist of bristles or filaments in tuft-like groups 92, integral with the brush backing element, such bristles being of relatively small diameter. The two inner rows 90 of bristles consist of clumps or tuft-like groups 94 of bristles, such bristles being of relatively larger diameter. As a result, there is provided a toothbrush in which the lip and gum engaging outer rows of bristles are relatively soft and small in diameter, whereas the tooth engaging or inner rows of bristles are relatively stiff.

It is also possible, in accordance with the invention, to provide the brush with deflection limiting means for the longer, smaller-diametered, bristles of some or all of the tuft-like groups of bristles. Thus in Fig. 7 there is shown a fragment 96 of a further embodiment of a brush or brush part in accordance with the invention. In such brush the backing designated 98 is integral with each of the bristles of the tuft-like group. In such tuft-like group 100 there are provided a plurality of circularly disposed, longer, smaller diametered, bristles 102. Centrally within such group there is positioned a shorter, stiffer, larger diametered, bristle 104, which tends to limit deflection of bristles 102 past a position much below the outer end of bristle 104.

A brush such as shown in Fig. 7 may readily be formed by the apparatus indicated in Fig. 8. Such apparatus is generally similar to that shown

in Fig. 5, and thus parts similar to those in Fig. 5 are designated by the same reference characters as employed in Fig. 5. The pin in this instance is designated 106. Such pin is provided with a plurality of angularly spaced flutes 108 which, as shown, form the longer, smaller diametered, bristles 102. In this instance such bristles are filleted, as shown. The shorter, larger diametered, central bristle 104 is formed by the central cavity 110 formed in the upper end of the pin 106.

It is apparent that the brush backing and bristles made by the apparatus and method in accordance with the invention may be made out of a number of suitable plastic materials. Typical materials which may be employed with success for such applications as for example, tooth brushes, are nylon and flexible polystyrene. In instances where the volume of the brush backing including the handle, etc., as a whole is appreciable, it may not be desired to make the entire brush including the handle integral. In such cases a brush incorporating the invention, shown in Fig. 9, may be employed. As there shown the brush 112 is of composite construction, the portion 122 of the main, bristle containing, brush part 114 being integral with the handle 116. The portion 118 of the bristle containing part of the brush, however, is made separate from part 122. The brush shown in Fig. 9 may conveniently be formed as follows.

The portions 122 and 116 of the brush are first formed by injection molding in an appropriately shaped mold cavity in a first molding machine. Such part consisting of portions 122 and 116 is preferably formed of a thermosetting resin such as phenol-formaldehyde or urea-formaldehyde. The upper face of portion 122 is provided with undercut portions 124, which may conveniently be formed by conventional retractable core pins in the first mold. The part consisting of portions 116 and 122 is cured, and is then placed in a mold in a second injection molding machine, as an insert in the appropriately shaped mold cavity, the upper face of portion 122 being exposed to the, as yet vacant, brush backing element and bristle forming cavity in such mold. Thereupon a plastic material such as the before-mentioned nylon or polystyrene is injected into the second mold to form the brush backing element 118 and the bristle groups 120 in the same manner as described above. The plastic material of part 118 flows into the undercut portions 124, and thus forms an integral bond between portions 122 and 118. For the sake of attractiveness of the composite brush, it may be desirable to form portion 122 with an upstanding flange portion which surrounds the side edges of portion 118 as shown, whereby the backing element of the resulting brush presents an integral appearance.

Whereas for purposes of illustration I have shown and described typical embodiments of the methods of, and of apparatus for forming brushes, it is to be understood that within the scope of the invention such method and apparatus may be varied considerably as to details. Accordingly, the invention is not to be limited to such described embodiments, but rather is to be defined by the scope of the claims appended hereto.

I claim as new the following:

1. A mold for a brush part having a backing element and bristles integral therewith which comprises a mold having a main, backing ele-

ment forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having at least one passage therethrough communicating with the mold cavity, one elongated member accurately fitting within each such passage, each elongated member having a plurality of longitudinally disposed flutes on its side surface, means to hold the elongated member in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the passage in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the passage in the first mold part, and means to thrust the elongated member outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

2. A mold for a brush part having a backing element and bristles integral therewith which comprises a mold having a main, backing element forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having a plurality of parallel passages therethrough communicating with the mold cavity, a plurality of spaced elongated parallel reciprocable members, one elongated member accurately fitting within each such passage, each elongated member having a plurality of longitudinally disposed flutes on its side surface, means to hold the elongated members in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the passages in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the passages in the first mold part, and means to thrust the elongated members outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

3. A mold for a brush part having a backing element and bristles integral therewith which comprises a mold having a main, backing element forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having a plurality of parallel bores therethrough communicating with the mold cavity, a plurality of spaced parallel pins, one pin accurately fitting within each such bore, each pin having a plurality of longitudinally disposed flutes angularly spaced about its side surface, means to hold the pins in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the bores in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the bores in the first mold part, and means to thrust the pins outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

4. A mold for a brush part having a backing element and bristles integral therewith, the juncture between the backing element and bristles being filleted, which comprises a mold having a main, backing element forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having a plu-

ality of parallel passages therethrough communicating with the mold cavity, a plurality of spaced elongated parallel reciprocable members, one elongated member accurately fitting within each such passage, each elongated member having a plurality of longitudinally disposed flutes on its side surface, the end of each flute adjacent the mold cavity and the portion of the passage sidewalls opposite such end of the flute diverging from each other in a direction toward the mold cavity, means to hold the elongated members in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the passages in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the passages in the first mold part, and means to thrust the elongated members outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

5. A mold for a brush part having a backing element and bristles integral therewith, the juncture between the backing element and bristles being filleted, the ends of at least some of the bristles remote from backing element being enlarged, which comprises a mold having a main, backing element forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having a plurality of parallel passages therethrough communicating with the mold cavity, a plurality of spaced elongated parallel reciprocable members, one elongated member accurately fitting within each such passage, each elongated member having a plurality of longitudinally disposed flutes on its side surface, the end of each flute adjacent the mold cavity and the portion of the passage sidewalls opposite such end of the flute diverging from each other in a direction toward the mold cavity, the ends of at least some of the flutes remote from the mold cavity being enlarged, means to hold the elongated members in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the passages in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the passages in the first mold part, and means to thrust the elongated members outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

6. A mold for a brush part having a backing element, tuft-like groups of bristles integral therewith, and deflection limiting means in the form of short stiff bristles positioned in at least some of the bristle groups, which comprises a mold having a main, backing element forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having a plurality of spaced parallel bores therethrough communicating with the mold cavity, a plurality of spaced parallel pins, one pin accurately fitting within each such bore, each pin having a plurality of longitudinally disposed flutes angularly spaced about its side surface, means to hold the pins in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the bores in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the bores in the first mold

part, an axially extending cavity in at least some of the pins, such cavity being of a length markedly less than the length of the flutes and of a diameter markedly greater than the cross-sectional dimensions of the flutes, and means to thrust the pins outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

7. A mold for a brush part having a backing element and a plurality of rows of tuft-like groups of bristles integral therewith, which comprises a mold having a main backing element forming, cavity therein, said mold being composed of at least two parts separable to allow withdrawal of the molded brush part, a first part of the mold having a plurality of rows of spaced parallel bores therethrough communicating with the mold cavity, a plurality of spaced parallel pins, one pin accurately fitting within each such bore, each pin having a plurality of longitudinally disposed flutes angularly spaced about its side surface, the flutes in some of the rows of pins being of a different size from those in the others of the rows of pins, means to hold the pins in such first mold part with the ends of the flutes remote from the main mold cavity positioned within the bores in the first mold part, thereby forming bristle forming cavities with closed bottoms between the surfaces of the flutes and the bores in the first mold part, and means to thrust the pins outwardly through the mold cavity forming surface of the first mold part, after the mold parts have been separated, to eject the molded brush part from the mold.

8. The method of forming a brush part having a backing element and bristles integral therewith comprising injecting moldable material into a mold, said mold being made of separable parts and having a main, backing element forming, cavity and bristle forming cavities in communication with each other, the portion of the mold containing the bristle forming cavities being formed by a first one of the separable parts of the mold and by an elongated member reciprocable through a passage in the first part of the mold, the elongated member having a plurality of longitudinally disposed flutes in its side surface, the ends of the flutes remote from the main mold cavity being positioned within the passage in the first mold part, allowing the injected material to harden in the mold cavity, separating the parts of the mold, moving the reciprocable elongated member into the backing element forming cavity in the first mold part thereby removing the backing element from the cavity in the first mold part and moving the bristles along their axes with respect to the first mold part, continuing such movement of the elongated member until the inner ends of the flutes in such member are clear of the end of the passage in the first mold part adjacent the mold cavity, thereby freeing the molded bristles of the brush part from the first mold part, and removing the molded brush part from between the mold parts by moving the bristles of the former initially parallel to the elongated member.

9. The method of forming a brush part having a backing element and bristles integral therewith, at least some of the bristles having enlarged outer ends, comprising injecting moldable material into a mold, said mold being made of separable parts and having a main, backing element forming, cavity and bristle forming cavities in communication with each other, the por-

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tion of the mold containing the bristle forming cavities being formed by a first one of the separable parts of the mold and by an elongated member reciprocable through a cylindrical passage in the first part of the mold, the elongated member 5 having a plurality of longitudinally disposed flutes in its side surface, the ends of at least some of the flutes remote from the main mold cavity being positioned within the passage in the first mold part and being enlarged, allowing the injected material to harden in the mold cavity, separating the parts of the mold, moving the reciprocable elongated member into the backing element forming cavity in the first mold part thereby removing the backing element from the cavity in the first mold part and moving the bristles along their axes with respect to the first mold part, continuing such movement of the elongated member until the inner ends of the flutes in such member are clear of the end of the passage in the first mold part adjacent the mold cavity, thereby freeing the molded bristles of the

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brush part from the first mold part, and removing the molded brush part from between the mold parts by moving the bristles of the former initially parallel to the elongated member, whereby the bristles having enlarged ends are sprung sidewardly to free such enlarged ends from the enlarged ends of the flutes.

LOUIS F. KUTIK.

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