Oct. 17, 1961 R. D. SCHAD 3,004,291

APPARATUS FOR FORMING BRUSHES

Filed Jan. 14, 1958 3 Sheets-Sheet 1

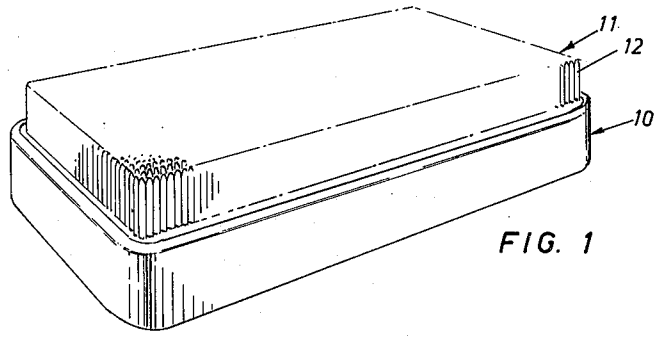

FIG. 1

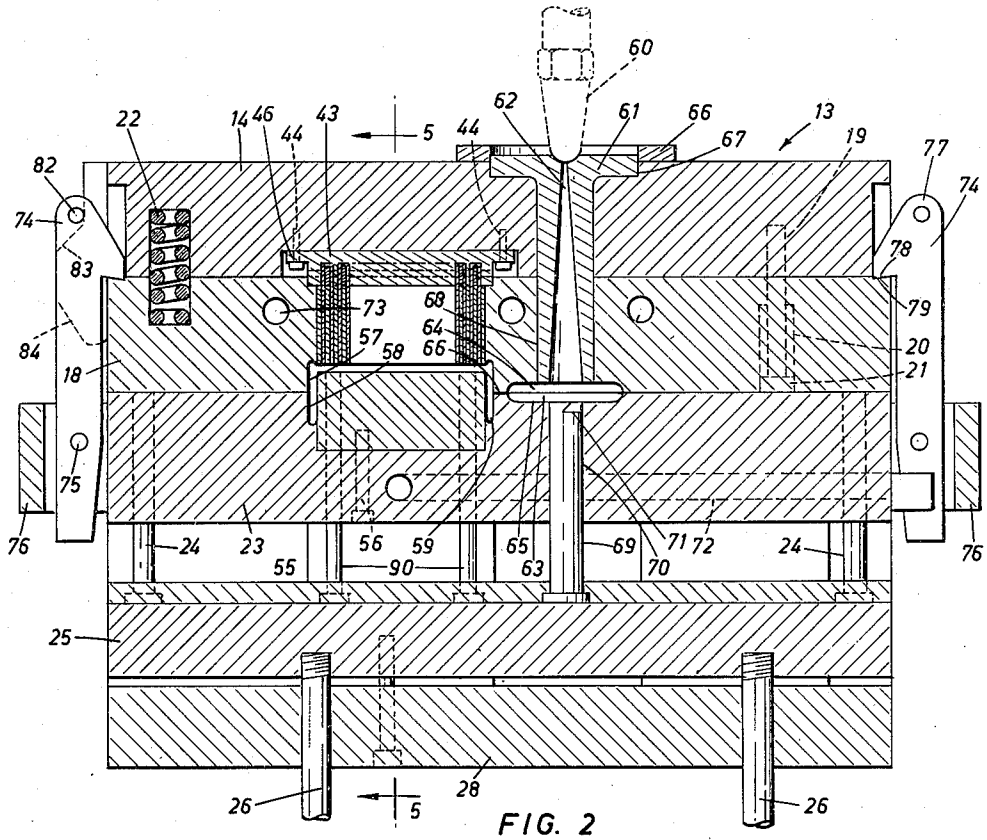

FIG. 2

Inventor
ROBERT D. SCHAD
by: J. Richard Bowman
Patent Agent

Oct. 17, 1961 R. D. SCHAD 3,004,291

APPARATUS FOR FORMING BRUSHES

Filed Jan. 14, 1958 3 Sheets-Sheet 2

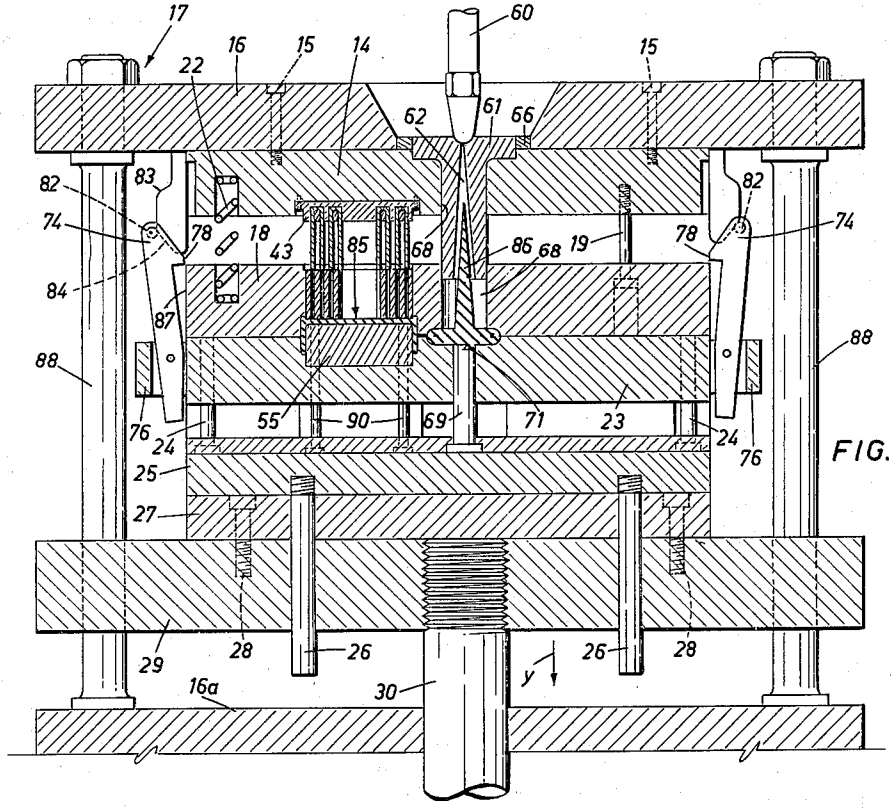

FIG. 3

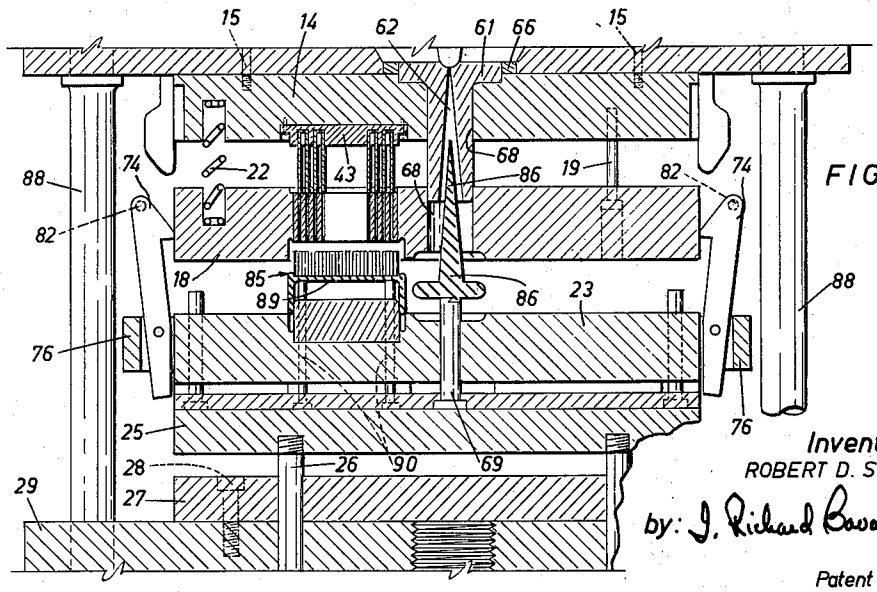

FIG. 4

Inventor
ROBERT D. SCHAD
by: J. Richard Cavanaugh
Patent Agent

Oct. 17, 1961 R. D. SCHAD 3,004,291

APPARATUS FOR FORMING BRUSHES

Filed Jan. 14, 1958 3 Sheets-Sheet 3

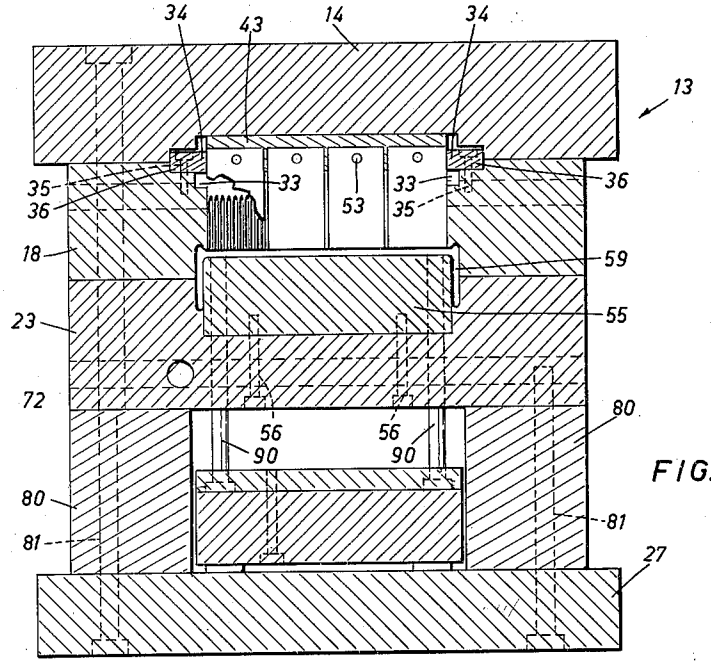

FIG. 5

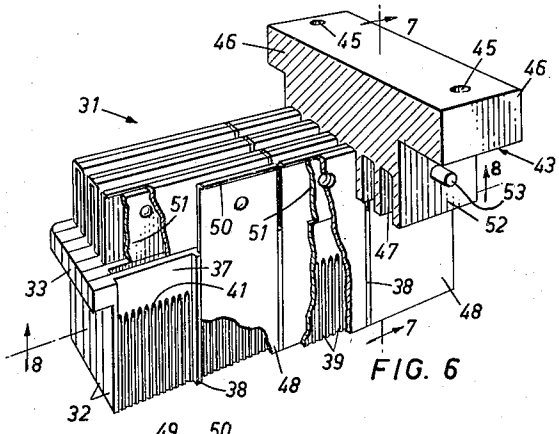

FIG. 6

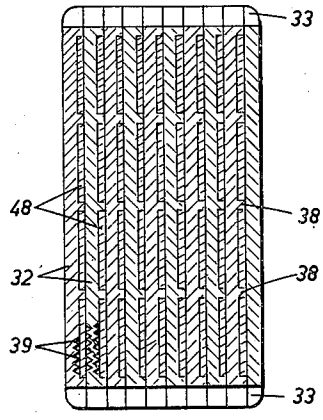

FIG. 8

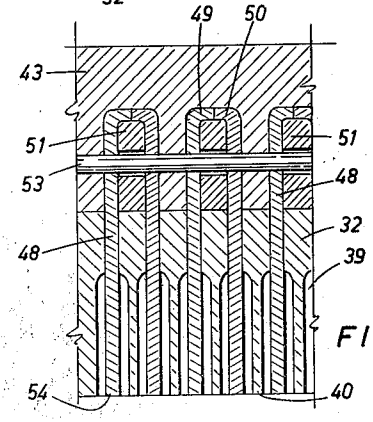

FIG. 7

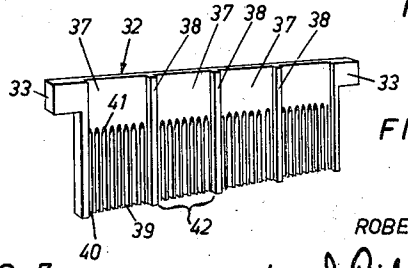

FIG. 9

Inventor
ROBERT D. SCHAD
by: J. Richard Bowman
Patent Agent

United States Patent Office 3,004,291 Patented Oct. 17, 1961

3,004,291

APPARATUS FOR FORMING BRUSHES

Robert Dietrich Schad, Toronto, Ontario, Canada, assignor to Eric Dent and Joseph Vallis, both of Toronto, Ontario, Canada

Filed Jan. 14, 1958, Ser. No. 708,952
3 Claims. (Cl. 18—42)

This invention relates to improvements in an apparatus for forming brushes and more particularly to a direct method and apparatus for forming a complete brush, characterized by bristle members integrally formed with the backing element, wherein the latter preferably serves as the brush handle.

Heretofore brush bristles have been integrally moulded with a backing member in groups to form a plurality of tufts of bristles on the backing member. Other than such examples, prior attempts to form a uniform fine distribution of bristles integrally on a backing member have not been successful for application in conventional injection moulding processes for the reason that the mould has been unduly complicated, restricting the number of bristles formed, and limiting the practicability thereof for application in injection moulding apparatus. Such prior moulds as have been designed require complicated operating mechanism and highly expensive die components, rendering the same relatively impractical for commercial use.

As contrasted with the prior art, the invention provides a relatively simple mould or die apparatus having three main separable components in the form of a stationary die plate having surfaces thereon adapted to define at least one surface of a row of bristle members to be formed, and a mould plate slidable thereon in a direction of the length of the bristles to be formed in said row, and defining with said die plate a bristle forming cavity for each bristle in the row, and a third mould part embodying a base cavity adapted to communicate with said bristle mould cavities and separable from said bristle mould part after motion accomplishing removal of said die plates from said bristle mould cavities thereby to enable removal of the brush form in said cavity and bristle cavities. The invention contemplates the parallel multiplication of bristle rows, as described to enable the direct moulding of a brush characterized by a multitude of fine bristles, preferably at a substantially uniform spacing less than one bristle diameter.

Other objects of the invention will be appreciated by a study of the following specification, taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a perspective view of one form of brush which may be made with the method and apparatus of the invention and which embodies multiple rows of relatively fine bristle members in close spaced relationship.

FIGURE 2 is a transverse sectional elevation of a separable mould block according to the invention adapted for injection moulding of the brush illustrated in FIGURE 1, and showing an injection nozzle associated therewith in chain lines. The components of the mould are in positions ready to accept the injection of mouldable substance therein:

FIGURE 3 is a sectional view of the main components of an injection moulding press surrounding a separable mould structure according to the invention illustrating a first stage of separation;

FIGURE 4 is a sectional view corresponding to FIGURE 3 but illustrating a further separation of the mould components to free the moulded article moulded therein;

FIGURE 5 is a longitudinal sectional elevation of the mould components of FIGURE 2 on the line 5—5 thereof;

FIGURE 6 is a perspective view partially cut-away of separable bristle die plate structure utilized for moulding multiple rows of relatively fine bristles of the invention in association with the other mould components illustrated in FIGURE 5 for the complete moulding of a brush or the like in one injection moulding;

FIGURE 7 is a sectional view on the line 7—7 of FIGURE 6;

FIGURE 8 is a sectional view on the line 8—8 of FIGURE 6;

FIGURE 9 is a perspective view of a single die plate according to the invention.

Referring to the drawings, one form of fine bristled brush which may be fabricated according to the invention is illustrated in FIGURE 1, and comprises a brush handle or base 10 integrally moulded with a plurality of preferably straight parallel rows of bristles 11, wherein each row consists of a multitude of relatively fine, preferably identical bristle members 12. Each of the bristle members is preferably triangular in section, although it may be semi-circular, or otherwise shaped, but preferably in any case having one straight side in section developing one flat surface for the bristle member, so that in a given row of bristle members all have, in the preferred construction, a flat surface lying in a common plane extending vertically along the row.

The separable mould structure of the invention is adapted for use in a conventional injection moulding machine and is generally designated by the numeral 13 in the following figures, such as in FIGURE 2. In this latter figure the main mould components will be evident in a head block 14 adapted to be fastened by bolts 15 to the stationary head 16 (FIGURES 3 and 4) of an injection moulding apparatus of a conventional injection moulding press head structure 17. A separable bristle die plate support block 18 is suspended by bolts 19 being slidable on the latter by way of sockets 20 slidable about bolt head 21 to fall to a support position under the action of the separating biasing springs 22 to the position indicated in FIGURE 3 as will be hereinafter described. A mould base support block 23 is vertically slidable on pins 24 extending rigidly upwardly from a mould base plate 25 which, in turn, is supportable by motion limiting posts 26 extending slidably therefrom downwardly through suitable accommodating bores in a mould ram plate 27 fastened by bolts 28 to an injection moudling machine ram head 29 movable under action of the piston arm 30.

The invention contemplates a separable die plate assembly for the moulding of the bristle members, which assembly may be of the form disclosed specifically in FIGURE 6 or of suitable modified form having regard to the design of closely packed fine bristle arrangement desired. The separable die plate assembly 31 comprises a plurality of plate-like members 32 adapted to be stacked laterally in close packed relationship as indicated in FIGURE 8, and having at their ends mounting flanges 33 adapted to be clamped in the die plate support block 18 (FIGURE 5) by the clamping bars 34 fastening by bolts 35 in the recess 36 of the block. Each die plate 32 is recessed at regular intervals to provide recessed side faces 37 separated by die plate spacer portions or members 38. The side faces 37 are preferably milled or otherwise machined to provide parallel bristle forming mould recesses or grooves 39, each adapted to define a half portion of a bristle to be moulded. Each of the mould recesses extends from the bottom or end face 40 of each die plate to an upper terminus 41 defining a predetermined length for each bristle to be moulded, and defining the end contour of the bristle end to be formed. It will be observed that the die plate may be formed in such manner as to provide a large number of bristles in any mould group 42 between adjacent spacers

38, and that a large plurality of groups may be incorporated in parallel longitudinally extending arrangement on any one die plate.

The die assembly embodies a mould head 43 adapted to be fastened by bolts 44 (FIGURE 2) through bores 45 in flanges 46 thereof, to the head block 14. The mould incorporates a plurality of parallel spaced apart relatively deep grooves 47 adapted to support therein a plurality of mould plates 48 slidable over the die faces 37 between the spacers 38 of each die plate to define a plurality of bristle mould cavities for each group 42 (FIGURE 9).

The mould plates, generally designated by numeral 48, are of rectangular nature adapted to extend the full height of a die plate between the spacers 38 thereof and to extend thereabove to provide a longitudinally extending mounting flange 49 or 50 inturned as indicated in FIGURE 7 so that a co-operating pair of such mould plates may seat upon a spacer bar 51 extending longitudinally above each die plate. The recesses 47 are defined by the downwardly projecting longitudinally extending web members 52 of the mould head 43 and slidably accommodate a plurality of transversely extending support rods 53 passing through the upper portions of each of the mould plates 48 and the spacers 51 therebetween in the manner indicated in FIGURE 7. It will be appreciated that each of the spacer bars is continuous for the full length of the mould head, whereas each of the slidable mould plates is adapted to cover only one group 42 of bristle die recesses 39.

As indicated in FIGURE 8, the die plates carry corresponding groups of bristle grooves on both sides. Therefore each mould plate will move slidably into moulding relation between biasing side faces of adjacent die plates upon vertical relative motion between the mould head fastening to head block 14 and the stacked array of die plates clamping in the die plate support block 18 as indicated in FIGURE 5.

When in moulding position as indicated in FIGURE 7 the end faces 40 of the die plates, and the end faces 54 of the mould plates will be in registry and are disposed in moulding spaced relation from a base mould block or backing mold member 55 fastened by bolts 56 in the mould base support block 23. As shown in FIGURES 2 and 5 the die plate support block 18 in the regions 57 and the mould base support block 23 in the regions 58 may, with the mould base block 55 and the end faces 54 and 40 of the die plate assembly, define a mould cavity 59 adapted to define a suitable base for a brush to be moulded in such manner that the base is moulded integrally with the bristles during formation of the latter. In other words, the cavity 59 communicates with each of the bristle bores defined by the abutting side faces of the adjacent plates 32, 48.

In operation, the die plate assembly is mounted within separable mould structure 13 as described with reference to FIGURES 2 and 5 to 9. The separable mould structure embodying the three main separable components that is the head block 14, die plate support block 18 and mould base support block 23 are then supported between the stationary head and ram of a suitable injection molding press such as that indicated by way of example in FIGURES 3 and 4. During the initial moulding operation a suitable plastic material such as nylon, polystyrene or thermosetting resins such as phenolformaldehyde or urea-formaldehyde is injected by conventional techniques by way of injection nozzle 60 (FIGURE 2) disposed in engagement with the sprue cap 61 having an internal conical communicating passage 62 extending from nozzle 60 to distributing cavity 63 defined by opposed recesses 64 and 65 communicating by passage 66 with the brush base cavity 59. It will be observed that the sprue cap 61 is flanged as at 66 and supported in a recess bore 67 of the head block 14 and further extends downwardly and slidably through a bore 68 in the die plate support block 18. In addition a sprue locking member 69 extends upwardly from the mould base plate 25 slidably within a bore 70 of the mould base bore block 23 to present a sprue key socket 71 within the distributing cavity 63. Thus in the assembled relation of the moulded components during the injection of plastic material the latter will flow down the communicating passage to the distributing cavity 63 thence through passage 66 to cavity 59 and thence to the bristle cavities or bores defined by the abutting side faces of plates 32, 48 which constitute the separable die plate assembly 31. During the injection moulding operation temperature may be controlled in the conventional manner by passing a temperature controlling fluid through the temperature controlling passages 72 and 73 of the mould base support block 23 and die plate support block 18 respectively.

After allowing sufficient time for setting of the plastic material within the separable die structure the ram head 29 is caused to withdraw in the direction of the arrow Y as indicated in FIGURE 3. In this connection it is desired to point out that the die plate support block 18 and mould plate support block 23 are retained locked in the assembled position indicated in FIGURE 2 by means of the spring biased locking arms 74 extending upwardly from pivot connection as at 75 to the support 76 therefor on the mould base support block 73 the upper end of which locking arm embodies an inwardly projecting locking dog or flange 78 adapted to engage clamping surfaces 79 of the die plate support block 18. Since, as is indicated in FIGURE 5, the mould base support block 23 is fixed in spaced relation by the end spacers 80 from the mould ram plate 27 and is fixed in spaced relation to the latter by the bolts 81, retracting motion of ram 29 will cause the mould base support block 23 to be retracted with the ram and will likewise cause the die plate support block 18 to be withdrawn with the block 23 by reason of engagement of the locking arm 74 therewith, thereby in the initial stage effecting separation of the head block 14 and die plate support block 18. The separation of blocks 14 and 18 is illustrated in FIGURE 3 in the full separated position of the components for this stage of operation. During separation of blocks 14 and 23 the locking arms 74 are deflected outwardly by engagement of free cam rollers 82 with the outwardly diverging cam surface 83 of cam bars 84 depending downwardly in fixed relation from the head block 14 and stationary machine head 16. Cam surfaces 83 cause the locking arm 74 to be deflected to the release position indicated in FIGURE 3 and maintain the locking arms in the outwardly released positions until the die plate support block 18 under action of springs 22 reaches the limit of its separation from the head block 14 determined by the motion limiting suspension bolts 19.

It will be appreciated that the first stage of separation of the separable mould of the invention in accomplishing the separation of the die plate support block from the head block 14 provides effectively for separation or withdrawal of the mould plates 48 from mould cavity defining position between the bristle die plates 32. As a consequence the further separation of the moulded part or article 85 from the remaining mould cavities is made practical. It will also be observed that at this stage the moulded sprue 86 by reason of it having been formed within the locking recess 71 of the sprue retaining member 69 and being retained within the distribution cavity 63 is withdrawn from the conical diverging communicating passage 62. As a second stage of separation of the separable mould components the locking arms are disposed by the cam bars 84 in positions for deflection of their locking dog portion 78 by the vertical side surfaces 87 of the die plate support block 18. Further retraction of the ram 29 therefore enables separation of the mould base support block 23

from the die plate support block 18, the latter having reached the limit of its separation with respect to the head block 14. Since the moulded bristles (not shown) in engagement with the bristle forming cavities 39 of the die plates are relatively free after removal of the mould plates 48 the formed bristle portions may be withdrawn easily from the die plate assembly providing there is a greater remaining surface area of contact between the moulded article and mould cavity surfaces on the mould base support block than those remaining surfaces in contact with the moulded part on the die plate support block. This requirement would appear to naturally follow in any design of brush wherein the bristles are integrally moulded with the backing member or handle in the one moulding operation according to the invention because the surfaces of the backing member opposite to the bristle members thereon will have a greater area of contact with their respective mould cavity surfaces than the area of the backing member between bristles in contact with the die plate bottom edge surfaces 40. Thus as the mould base support block 23 is further retracted by the retracting motion of the ram head 29 the moulded part 85 will be drawn downwardly therewith in corresponding motion until the motion limiting posts 26 engage the opposed stationary head 16*a* fastened to stationary head 16 and spaced in parallel fixed relation therefrom by bolts 88 of the injection moulding apparatus. At this point of operation the mould base plate 25 will be rendered stationary and further retracting motion of the ram head 29 will cause the mould base support block 23 to be further withdrawn therewith effecting engagement of the backing member 89 of the moulded part 85 to be engaged and supported in a stationary position by the parting posts 90 extending from the mould base plate 25 slidably upwardly through the mould base support block 23 within the mould base block 55. It will also be observed that at this part of the operation the sprue locking member is rendered stationary because it is supported by the mould base plate 25 the limit of travel of which has been determined by the motion limiting posts 26 in engagement with the stationary head 16*a*.

Further retracting motion of the ram head 29 therefore separates the mould base support block 23 from the moulded article 85 and the sprue 86. The moulded article and sprue are then removed in the usual way. The separable mould may then be collapsed to the initial moulding position indicated in FIGURE 2 by advancing the ram head 29 until the locking arms 74 fall into full locking engagement with the die plate support block 18 as described.

As may be seen from FIG. 5, the elements 14 and 18 cooperate to form a plate means which carries a bristle mold means, this bristle mold means being formed by the alternating stacks of elements 32 and 48. Referring to FIG. 7 it will be seen that the ends 40 and 54 of the elements 32 and 48 define an end face of the bristle mold means 32, 48, and this end face defines part of a mold cavity 59 which is the cavity in which the back of the brush is formed. Returning to FIG. 5, it will be seen that element 23 forms a second plate means which carries a backing mold means 55, this backing mold means 55 cooperating with the bristle mold means 32, 48 to define the cavity 59 in which the brush backing member 89 will be formed. In accordance with the invention the bristle mold means 32, 48 is provided by cooperation of elements 32 and 48 with a plurality of bores extending away from the end face 40, 54 of the bristle mold means and these bores respectively terminate in closed ends distant from the end face 40, 54 so that the several bores of the bristle mold means 32, 48 communicate with each other only by way of the mold cavity 59 defined between the backing mold member 55 and the end face 40, 54 of the bristle mold means 32, 48. As is evident from FIG. 4, the brush can be removed from the mold upon separation of the plate means 23 from the element 18 of the plate means 14, 18, the plate means 14, 18 and the plate means 23 being shown in FIG. 5 in their operative molding position where they engage each other and carry the backing mold means 55 and bristle mold means 32, 48 in the position illustrated in FIG. 5 so as to form the brush 85, while the parts are shown in FIG. 4 in an inoperative withdrawal position where the plate means 23 is spaced from element 18 of the plate means 14, 18 so as to permit withdrawal of the molded article 85.

Having regard to the foregoing, it will be appreciated that the invention concerns a mould having a plurality of die plates in stacked relationship each of the plates having side faces each disposed in opposed relationship with respect to a side face of an adjacent plate spaced from the latter. A mould plate is insertable between the spaced opposed die faces to a position fully between the latter to define therewith a multitude of bristle bores. In a more specific sense, the bristle forming grooves on each die plate are formed in multitudinous array therealong, each groove being spaced from the next a distance less than the diameter of the bristle to be formed. In this sense it will be appreciated that the term diameter is intended to refer to the maximum transverse dimension of a bristle since the bristle shape need not be truly circular but may be in fact elliptical or preferably triangular in section.

The invention also concerns a brush member having bristles and a backing element made of moulded plastic material the bristles and backing member being integrally moulded in one piece the bristles being disposed on the backing element in uniform closely packed multitudinous number. More specifically, the bristles are disposed on the backing element in substantially uniform closely packed relationship at a spacing less than the diameter of a bristle.

It is intended that the disclosure of this invention should not be construed in any sense limiting the concept thereof, except as may be exemplified by the following claims having regard to the state of the art.

What I claim as my invention is:

1. In a brush molding apparatus, in combination, a series of grooved plates located in a row parallel to each other with portions spaced from each other, and said spaced portions each being formed in opposed side faces with parallel grooves extending from a side edge of each grooved plate; a series of flat plates respectively alternating with said grooved plates and located against said portions thereof extending across said grooves, said flat plates having flat faces extending across said grooves to form with the latter bristle bores in which bristles are molded; a backing mold member spaced from the edges of said grooved plates from which said grooves thereof extend but located adjacent said edges; a pair of spaced carrier plates respectively carrying said flat plates and said backing mold; and an intermediate plate carrying said grooved plates, said pair of spaced plates and said intermediate plate all being movable toward and away from each other for opening and closing a mold of which they form a part, the movement of said flat plates from said grooved plates uncovering part of the bristles located in said grooves to facilitate the removal of the molded article from the mold.

2. In a brush molding apparatus, in combination, a series of first plates each having opposed side faces and an end face intermediate said side faces, said side faces formed with parallel grooves extending from the respective end face; a series of second plates respectively alternating with said first plates and having flat faces extending across said grooves to form with the latter bristle bores in which bristles are molded upon introduction of mold material into said bores; a backing mold member spaced from but adjacent to said end faces, said backing mold member and said plates defining between themselves a mold cavity for reception of mold material to form the base of the brush, said cavity communicating

with said bristle bores; means for moving one of said series of plates with respect to the other series of plates to separate the bristles from said second plates; and means for causing movement between said first plates and the base of the brush in the longitudinal direction of the bristle bores to space the base of the brush from said end faces and to thereby separate the bristles from the first plates.

3. In a brush molding apparatus, in combination, a separable die plate assembly including a plurality of adjacent parallel plates having abutting side faces and end faces extending between said side faces, the abutting side faces of the adjacent plates forming pairs of side faces and one of each pair of side faces formed with parallel grooves extending from the respective end face and the other of each pair of abutting side faces extending across said grooves to form with the latter bristle bores in which bristles are molded upon introduction of mold material into said bores; a backing mold member spaced from but adjacent to said end faces, said backing mold member and the end faces of said plates defining between

themselves a mold cavity for reception of mold material to form the base of the brush, said cavity communicating with said bristle bores; means for moving alternate plates of said plurality of plates with respect to the other plates to separate the other side faces of each of said pairs of abutting side faces from the bristles formed in said bores; and means for causing movement between the base of the brush and the bristle bores in the longitudinal direction of the bristle bores to space the base of the brush from the end faces and to thereby separate the bristles from the grooved side faces.

References Cited in the file of this patent

UNITED STATES PATENTS

2,355,744	Myers	Aug. 15, 1944
2,566,817	Yellin	Sept. 4, 1951
2,645,804	Gantz et al.	July 21, 1953
2,651,810	Snyder	Sept. 15, 1953
2,783,490	Kutik	Mar. 5, 1957
2,783,501	Kutik	Mar. 5, 1957
2,783,502	Abplanalp	Mar. 5, 1957