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COMPLETE SPECIFICATION

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TITLE

A TOOTHBRUSH AND A METHOD OF PRODUCING A TOOTHBRUSH

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The following specification particularly describes the nature of this invention and the manner in which it is to be performed

The invention relates to a toothbrush and a method of producing a toothbrush.

Toothbrushes are mass-produced articles and must therefore allow cost-effective production. Toothbrushes made of a single plastic material and toothbrushes made of two plastic components, which are produced for example by the two-component injection-molding process, are known. In the latter case, the toothbrush comprises two plastic parts: a first plastic part made of a first plastic material, for example polypropylene, extends from the handle of the toothbrush up to the brush head and has interconnected recesses. A second plastic part made of a second plastic material, for example thermoplastic elastomer, fills the recesses of the first plastic part. These two plastic materials bond with one another at the surface where the two plastic parts touch. In comparison with a toothbrush made of only one plastic material, this provides greater scope for design. Since, however, the two plastic materials have to bond with one another during the injection-molding operation, there are restrictions in the selection of the plastic materials and consequently in the design of the toothbrush.

This problem also affects other plastic objects for use in personal hygiene comprising at least two parts made of different plastic materials, such as for example containers or closure caps for containers intended for personal-hygiene preparations and substances, or for medical and dental preparations. There are restrictions in the selection of materials for the two parts in the case of such plastic objects as well.

A toothbrush and a method of producing a toothbrush of the generic type are known from DE-A-195 35 134. Injection-moulded onto a main plastic body of the handle of a toothbrush is a flexible plastic. In order to ensure reliable anchorage of the flexible plastic in the main body from the outset, the main body is provided with a central injection channel, which communicates from the inside with outer injection moulded areas of the more flexible plastic on the main body.

Furthermore, it is generally known in injection-moulding technology that non-positive fits can be realized by shrinkage processes, for example in the encapsulation of so-called "inserts' with plastic.

Similarly a compact leak-resistant seal for thermal ink jet print cartridge ink reservoir is disclosed in EP0561051. Connector for medical transfusions etc.- is made of plastics by injection moulding in two stages using rigid polypropylene for 1st and elastomer in 2nd to shrink on in situ is disclosed in DE4036361. Connecting arrangement of shaped resin parts and process for connecting said shaped resin parts is disclosed in DE3820814.

The present invention is based on the object of providing a toothbrush of the type mentioned at the beginning with which varied design is possible along with cost-effective production.

This object is achieved according to the invention by a toothbrush as described herein. The method of producing such a toothbrush is distinguished according to the invention by features as described herein. Preferred developments of the toothbrush according to the invention and of the method according to the invention form the subject matter as described herein.

Accordingly the invention provides a toothbrush comprising a toothbrush comprising a first moulded part, having a brush head, made at a plastic material resistant to tooth-cleaning agent containing peppermint oil, and a second moulded part, forming at least part of a handle, the two firmly interconnected moulded parts consisting of different plastic materials which do not bond with one another during the injection-moulding operation, characterized in that, for producing the firm connection between the two moulded parts, the one moulded part is at least partially enclosed by the other moulded part with the formation of a shrink fit, and the second moulded part consists of a plastic material which is less resistant to tooth-cleaning agent containing peppermint oil than the plastic material of the first moulded part.

Accordingly the invention also provides a method of producing a toothbrush as described hereinabove, wherein by means of injection moulding, in which a moulded part is injection-moulded from a first plastic material in a first step and another moulded part is subsequently injection-moulded from a second plastic material, which does not bond with the first plastic material during the injection-moulding operation, in a second step, a plastic material which is resistant tooth-cleaning agent containing peppermint oil being used for the injection-moulding of the moulded part having a brush head and the moulded part without the brush head forming at least part of a toothbrush handle, characterized in that the one moulded part is at loner partially enclosed by the other moulded part with the formation of a shrink fit, and a plastic material which is less resistant to tooth cleaning agent containing peppermint oil than the plastic material of the moulded part having the brush head being used for the injection-moulding of the moulded part forming at least part of the toothbrush handle.

The fact that the two parts of the plastic object are formed by at least two molded parts consisting of different plastic materials which do not bond with one another during the injection-molding operation and are joined to one another in particular by a non-positive and/or positive fit means that there are many possibilities for an expedient design of the plastic object. Plastic materials of different chemical character can be used. They may differ to a greater or lesser extent in their structural formula and their chemical components. At the surfaces where they touch, there do not have to be any chemical or physical bonds, for example in the form of bridge formations or van der Waals forces, between the plastic materials. The frictional forces alone between the molded parts in the joint, preferably constructed in the manner of a shrink fit, are adequate to join the two molded parts firmly to one another. The positive fit realized by means of parts engaging in one another at the surfaces where the two molded parts touch prevents gaps into which water and contaminants can penetrate, or which can even lead to rupture, from forming between the two molded parts during the shrinking operation.

Therefore, in the case of a toothbrush for example, plastic materials with advantageous properties can be used at the right place. The one molded part may consist, for example, of polypropylene (polypropylene is available inexpensively, is flexible, chemically resistant but not completely transparent), while styrene acrylonitrile (SAN) (likewise inexpensive, transparent, esthetic) may be chosen for example for the other molded part. The molded part bearing the brush head is advantageously produced from polypropylene, since polypropylene is resistant to the often aggressive substances of the tooth-cleaning agents.

The two plastic materials advantageously have a different shrinkage behavior, since a firm shrink fit can be achieved more easily in this way. In this case, that molded part which is produced from plastic material with the lower degree of shrinkage is advantageously produced in a first step. The second molded part is produced from plastic material with the greater degree of shrinkage in a second step, thereby achieving a natural pressure of the second plastic material pressing against the first plastic material.

The invention is explained in more detail below with reference to the drawing, in which:

FIG. 1 shows a first exemplary embodiment of a toothbrush comprising two molded parts in side view and partially in longitudinal section;

FIG. 2 shows the toothbrush according to FIG. 1 in plan view;

FIG. 3 shows the toothbrush according to FIG. 1 in a view from below;

FIG. 4 shows a first molded part of the toothbrush according to FIG. 1 in elevation and partially in longitudinal section;

FIG. 5 shows the molded part according to FIG. 4 in plan view;

FIG. 6 shows a second molded part of the toothbrush according to FIG. 1 in plan view;

FIG. 7 shows a section along line VII--VII in FIG. 6;

FIG. 8 shows a joint of the two molded parts according to FIG. 1 on an enlarged scale;

FIG. 9 shows a section along line IX--IX in FIG. 2 on an enlarged scale;

FIG. 10 shows a second exemplary embodiment of a toothbrush comprising two molded parts in side view;

FIG. 11 shows the toothbrush according to FIG. 10 in plan view; and

FIG. 12 shows the toothbrush according to FIG. 10 on an enlarged scale, in side view and partially in section, a closure part for closing a handle cavity from the remaining part of the toothbrush being represented separately.

According to FIGS. 1 to 3, a toothbrush 1 has a first molded part 2, which bears a brush head 3 in its front region 2a. The first molded part 2, consisting of a plastic material A, is enclosed over a portion of its length, to be specific its rear handle region 2b, by a second molded part 4, consisting of a plastic material B, and is non-positively joined to the latter in the manner of a shrink fit. The plastic materials A and B are plastic materials of a kind which do not bond with one another during the injection-molding operation at the surfaces where they touch.

For better illustration, the two molded parts 2, 4 are represented separately from one another in FIGS. 4 to 7. The two molded parts 2, 4 have - as described further below - in the region where they touch diametrically opposite projections and recesses engaging in one another, by means of which a positive fit of the two molded parts 2, 4 is realized in addition to the non-positive fit of the same. It goes without saying that this joint is only produced during the injection-molding operation, in which one of the molded parts is injection-molded in a first step and then the other molded part is injection-molded around or into the first part in a second step. With the different degree of shrinkage of the two molded parts 2, 4, that molded part which is to be

produced from plastic material with a lower degree of shrinkage is advantageously injection-molded first. In the second step, injection-molding of the other molded part takes place from plastic material with a greater degree of shrinkage, whereby a natural pressure of the second plastic material pressing against the first plastic material is produced.

The second molded part 4, represented individually in FIGS. 6 and 7 and essentially forming the toothbrush handle, is designed in the form of a sleeve, i.e. is provided with an internal longitudinal bore 7, which corresponds in its shape and diameter to the rear handle region 2b of the first molded part 2, represented individually in FIGS. 4 and 5. The sleeve-shaped molded part 4 has an outer surface 6.

A front end face 8 of the sleeve-shaped second molded part 4 is assigned to an offset surface 9 of the first molded part 2 (FIG. 4), seen in the longitudinal direction of the toothbrush. In this case, an annular, front projection 10 of the second molded part 4 protrudes into a diametrically opposite recess 11 of the first molded part 2, which can be seen particularly well from FIG. 8. A rear end face 14 of the sleeve-shaped second molded part 4 is assigned to an offset surface 16 of an end piece 15 of the first molded part 2. Here, too, an annular, rear projection 17 of the second molded part 4 protrudes into a diametrically opposite recess 18 of the end piece 15.

The second molded part 4 is provided with a cross-sectionally oval, elongate cross-bore 20, which is arranged transversely to the longitudinal bore 7 and is intended for a diametrically opposite part 21 of the first molded part 2, penetrating through the cross-bore 20. The oval part 21 has an upper edge surface 22 and a lower edge surface 22'. The second molded part 4 is provided with offset surfaces 23, 23', which run around the cross-bore 20 and are diametrically opposite the edge surfaces 22, 22'. The edge surfaces 22, 22' and the offset surfaces 23, 23' in turn form a type of projection/recess positive-fitting joint between the two molded parts 2, 4.

Together with outer surfaces 19, 19' (FIG. 4) of the oval part 21, the outer surface 6 of the sleeve-shaped molded part 4 forms a handle surface.

As far as the material for the two molded parts 2, 4 is concerned, polypropylene (PP) may be advantageously chosen, for example, as the plastic material A for the first molded part 2, while the second molded part 4 may consist, for example, of the following plastic materials B:

styrene acrylonitrile (SAN) and subgroups,

acrylonitrile-butadiene styrene (ABS) and subgroups,

polyamide (PA) and subgroups,

polycarbonate (PC) and subgroups,

polyester (PBT) and subgroups, or other transparent plastic materials not bonding with polypropylene (PP).

The respective subgroups comprise the plastic materials belonging to the corresponding family.

This combination of materials provides a special advantage. Since modern tooth-cleaning agents often contain aggressive substances, such as peppermint--oil for example, cheap plastics, such as SAN for example, are often attacked. If the first molded part 2, bearing the brush head 3, is made of PP, which is resistant to the aggressive substances but not completely transparent, and the second molded part 4, comprising the handle, is made of transparent, but less resistant SAN, this special embodiment of the invention constitutes a toothbrush which can be produced cost-effectively, is resistant to the aggressive substances of the tooth-cleaning agents and is also able to be aesthetically pleasing. Of course, any other resistant plastic material may be used instead of PP and one of the cheaper, and therefore generally less resistant, plastic materials mentioned above may be used, for example, instead of SAN.

With these combinations of materials, preferably the second, sleeve-shaped molded part 4 is produced first, by means of injection molding, in a first step. Subsequently, the first molded part 2 is injection-molded in a second step, the positive fit already described being produced in the region where the two molded parts 2, 4 touch. The greater degree of shrinkage of the last-molded material A (PP) of the first part 2 has the effect of producing a natural pressure, pressing against the second part 4 consisting of material B (for example SAN), and a non-positive and positive fit of the two molded parts 2, 4 is brought about by the projections 10, 17, 22, 22' engaging in recesses 11, 18, 23, 23', without gaps into which water and contaminants can penetrate, or which can even lead to a rupture, forming between the plastic materials A, B, which actually do not bond with one another.

As an example, a toothbrush 1 comprising two molded parts 2, 4 has been presented and described. A different configuration of the two molded parts would be quite possible. The sleeve-shaped configuration of one of the molded parts is not absolutely necessary.

It goes without saying that a toothbrush could also have a plurality of molded parts made of plastic materials not bonding with one another during the injection-molding operation, which are joined to one another by a non-positive and/or positive fit.

Instead of the shrink fit and positive fit described, the individual molded parts, which do not enter into an adhesive or cohesive bond during the injection-molding operation, could be non-positively and/or positively joined to one another in any other way.

However, molded parts comprising two or more plastic components of which, for example, one (or more) component(s) of the one molded part cannot be bonded with one (or more) component(s) of the other molded part, could also be non-positively and/or positively joined to one another.

Represented in FIGS. 10 and 11 is a second exemplary embodiment of a toothbrush 1'.

which likewise has two molded parts 32, 34 consisting of different plastic materials A and B which do not bond with one another during the injection-molding operation. Here, too, the first molded part 32 forms a toothbrush part bearing the brush head 3' (the bristles of the brush head 3' are not represented in FIGS. 10 and 11; only the depressions 35 intended for anchoring tufts of bristles can be seen). The second molded part 34 forms a toothbrush handle. This is provided over part of its length with a cylindrical hollow 36, by which a cavity 37 which is open toward the rear and can be closed by means of a closure part 38 is formed in the toothbrush handle. The second molded part 34 preferably consists of an at least partially transparent or translucent material component, for example SAN, so that various aesthetically acting means (loose objects, liquid, powder, printed rollers etc.) can be visibly accommodated in the cavity 37. The closure part 38 may be joined undetachably or detachably to the second molded part 34. In the latter case, useful objects, such as toothpicks or ampoules with mouth wash or toothpaste, may also be accommodated, for example, in the cavity 37.

In the case of this embodiment of a toothbrush as well, the surfaces where the two molded parts 32, 34 touch are provided with parts 40, 41 engaging in one another, so that the two plastic parts are brought into a non-positive and positive fit during injection molding. The parts 40, 41 engaging in one another are formed, for example, by a projection 40 on the end face of the molded part 34 forming the handle and a diametrically opposite recess 41 on the end face of the other molded part 32.

If the handle is produced from the transparent SAN, it is also the case with this embodiment that this handle-forming molded part 34 is preferably produced first in the injection-molding process and the molded part 32, bearing the brush head, is subsequently injection-molded, for example from more resistant polypropylene.

Both the bristle-bearing part of the toothbrush and the handle may have parts consisting of further material components. For example, a depression for a thumb rest 42, of a further material component, for example a thermoplastic elastomer (TPE), may be provided, for example, in the molded part 34.

The toothbrush shown in FIG. 12 corresponds to the toothbrush 1' according to FIGS. 10 and 11, but is represented on an enlarged scale in comparison with FIG. 10 and partially in section (the same parts are denoted by the same reference numerals). This toothbrush 1' is intended for the insertion of variously filled ampoules 45, for which a holder 46 of an elastically compliant plastic is present in the front region of the hollow 36. The closure part 38 is provided on the inside with an elastically compliant counterholder 38'. The ampoule 45 is held both radially and axially in its position by the two holders 46, 38'. The holder 46 may, for example, be injection-molded from the same plastic (preferably from PP) and in the same step with the molded part 32 bearing the brush head 3' (the joining channel present for this is denoted by 47 in FIG. 12). From the same plastic material and in the same step, a cross-bore 48 may also be filled in the molded part 34 injection-molded first (for example from SAN), whereby the thumb rest 42 is formed on the outer side of the handle.

The ampoules 45 may contain various esthetically acting objects (loose or suspended in a liquid), liquid, powder etc.