

This invention relates to a cutter assembly for dry shaving apparatus, including cutter blades of circular circumference arranged on a carrier transversely to its longitudinal axis.

In prior known cutter assemblies of this type, a hollow cylinder is provided serving as the carrier of the annular cutter blades which--being equidistant from each other--are embedded in the hollow cylinder which is made of plastic or metal, for example, of aluminum. An axial collar provided on either end of the hollow cylinder serves for insertion of the cutter assembly so configured into circular recesses of a coupling bridge which is connected with the drive of the dry shaving apparatus and oscillates in the direction of longitudinal extension of the cutter assembly (Japanese Utility Model JP-GM 48-42301).

To relocate the cylindrical cutter assembly for the purpose of positioning at least two diametrically opposite circumferential areas of the cutter after one half or one third of the effective cutter circumference is worn down, the carrier body provides at its end a triangular collar or suitable recesses which cooperate with corresponding recesses or projections provided on the coupling bridge receiving the cutter assembly (Japanese Utility Model JP-GM 49-200).

In the prior known structure of cylindrical cutter assemblies, the configuration of the carrier has proved a problem, in particular where smaller cutter assemblies with diameters in the range below 10 mm are used. Whilst the carrier has to maintain a thickness sufficient to avoid deflection of the cutter assembly under the shaving pressure and to ensure the necessary embedding depth for the cutter blades which is indispensable to secure them in position on the carrier, compliance with these requirements makes the carrier excessively heavy, particularly if it is made of metal, so that the range of application of such cutter assemblies is rather limited.

It is, therefore, an object of this invention to provide a cutter assembly of the type initially referred to which, while being of low weight, can be maintained mechanically stable to resist deflection, which ensures a secure mounting of the cutter blades with good heat dissipation, and which can be manufactured at low cost in particular with small cutter blade diameters.

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This object is accomplished by the invention providing for the cutter blades to be received by a cylindrical metal-plastic carrier comprising a metallic core and a cylindrical plastic body encasing it closely and forming a compact unit therewith.

Such a metal-plastic carrier for holding the circular cutter blades of the cutter assembly is distinguished by its good stability, because the close bond between its metallic core and the plastic body material applied by injection molding results in a carrier unit which is of extremely high flexural strength and non-distorting properties. In addition, the circular cutter blades which are required to be optimally anchored to this metal-plastic carrier, owing to their polydirectional location in the carrier material, possess a consistently good flexibility in any direction and afford consistently good shaving results at any point of their cutting edges. Finally, these cutter blades can be manufactured to an extremely high degree of precision relatively simply by cylindrical grinding. The cylindrical grinding method also enables the cutter blades to be manufactured to relatively small diameters which, in turn, allows the manufacture of correspondingly small cutter assemblies. Accordingly, the cutter assemblies of the invention enable shaving systems to be realized which are of relatively small dimensions and are distinguished for conforming particularly well to those contours of the user's skin that are identified as problem zones.

More specifically, the cutter blades of the invention are anchored in the metallic core of the metal-plastic carrier by retaining means arranged on the core circumference at predetermined relative distances.

This arrangement results in a durable location and bearing and an accurate positioning of the cutter blades directly on the metallic core of the metal-plastic carrier of the cutter assembly.

However, the same effect can be achieved if the cutter blades have their concentric inner edges directly seated on the metallic core of the metal-plastic carrier and are positioned thereon in a mold serving for the manufacture of the cutter assembly before the material forming the plastic body is injection-molded around the core.

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This arrangement, too, ensures a secure location and bearing of the cutter blades on the metallic core of the metal-plastic carrier, with the lateral support provided to these blades by the material of the plastic body which encases the core eliminating the need for special retaining means on the metallic core.

Moreover, a particularly good location of the individual cutter blades of the cutter assembly in its metal-plastic carrier is accomplished by providing the cutter blades with preferably cloverleaf cutouts arranged symmetrically to their concentric inner edges which directly surround the metallic core, these cutouts allowing passage of the liquid plastic material during injection molding of the plastic body to fill the chambers defined by the cutter blades until the plastic body has reached the desired thickness.

The metallic core of the cutter assembly may embody different forms. Thus, in particular with a view to securely locating the metallic core in the plastic body encasing it, it is an advantage to configure the metallic core of the cutter assembly as a profiled bar of polygonal cross section having longitudinal grooves throughout its length, its ribs corresponding with the inner edges of the cutter blades. In the mold, this embodiment also allows the liquid material forming the plastic body--providing for positive engagement with the profiled bar--to flow through the longitudinal grooves into the spaces between the cutter blades.

In a practical modification of the subject of the invention in which the cutter blades are anchored to the metallic core, the metallic core of the cutter assembly is particularly advantageously formed of a tube having on its circumferential surface equidistantly spaced annular mounting grooves for insertion and positioning of the individual cutter blades.

For securely locating the cutter blades thus anchored to the metallic core in the entire metal-plastic carrier of the cutter assembly, the cutter blades positioned in, and located in positive engagement with, the mounting grooves provided on the circumferential surface of the tubular metallic core have recesses which in the mold are penetrated by the still liquid material of the plastic body encasing this tube.

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Finally, it is within the scope of this invention to manufacture the metal-plastic carrier of the cutter assembly by pressing the metallic core in the mold after the injection-molding process into the plastic body having a concentric axial bore.

An embodiment of the invention encompassing several modifications will be explained in more detail in the following with reference to the accompanying drawing, wherein:

FIG. 1 shows the shaving head of a dry shaving apparatus having a cylindrical cutter assembly driven by an oscillating coupling bridge;

FIG. 2 is a longitudinal sectional view of the cutter assembly;

FIG. 3 is a top plan view of the end of the cutter assembly of FIG. 2;

FIG. 4 is a top plan view of the end of the cutter assembly illustrating a modification thereof; and

FIG. 5 shows another modification of the cylindrical cutter assembly of the invention.

FIG. 1 shows in a general view the shaving head 1 of a dry shaving apparatus having a cylindrical cutter assembly 2 whose circular cutter blades 3 are arranged to cooperate with a shaving foil 4 mounted in a shaving head frame 5 which is adapted to be seated on a flange of the casing 6 of the dry shaving apparatus.

The casing 6 houses a vibrating armature motor, not shown, which drives via an oscillating lever 7 and an elastic coupling means 8 a U-shaped coupling bridge 9 receiving the cutter assembly 2. In this arrangement, this is accomplished by a collar 10 formed on either end of the cutter assembly 2 and engaging into a respective fork-shaped end 11 of the coupling bridge 9. A compression spring 12 which is operatively associated with, and bears against, the elastic coupling means 8 resiliently urges the cutter assembly 2 thus secured in position in the coupling bridge 9 into engagement with the shaving foil 4 mounted on the shaving head frame 5 by snap fasteners, for example.

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As becomes apparent from FIG. 2 showing the cutter assembly 2 in longitudinal section, the cutter assembly 2 comprises a metallic core 13 concentrically encased by a rotationally symmetrical body 14 of plastic material. The individual cutter blades 3 are placed on the metal-plastic carrier 15 thus formed, such that their concentric inner or perforated edges 16 are in direct seating engagement with the core 13. As shown more clearly in FIG. 3, the inner edges 16 of the cutter blades 3 have cloverleaf cutouts 17 which in the manufacture of the cutter assembly 2 allow passage of the still liquid plastic molding material of which the body 14 is formed, whereby the spaces between the cutter blades 3 are filled and a solid connection is formed due to the body 14 embedding the cutter blades 3 which, on the other side, bear directly against the metallic core 13.

FIG. 3 which is a top plan view of the end of the cutter assembly 2 on the side closed by the cutter blade 3 shows still more clearly how each individual cutter blade 3 is integrated into the metal-plastic carrier 15 by being embedded into the plastic body 14 by means of its cloverleaf cutouts 17 through which in the manufacturing process the plastic molding material flows, the cutouts bordering directly on the metallic core 13 of the carrier 15 and surrounding it symmetrically.

In the manufacturing process referred to above, not only the cutter blades 3 but at the same time also the metallic core 13 is embedded in, that is, firmly encased by, the plastic body 14, which is accomplished, for example, by centering the parts in a mold used in the manufacture of the cutter assembly 2.

By turning about its longitudinal axis y , the cylindrical cutter assembly 2 permits the selective use of different sections of its cutter blades 3 for cooperation with the shaving foil 4 of the dry shaving apparatus. The relocation of the cutter assembly 2 within the forks 11 of the coupling bridge 9 necessary for this purpose is facilitated by thumbholes 18 provided on the ends of the metal-plastic carrier 15 which allow the cutter assembly to be grasped safely for relocation or exchange.

To securely locate the cutter assembly 2 in its new position of use following such relocation or exchange, two parallel centering surfaces 19 are formed on the circumference of the metal-plastic carrier 15 in the area of engagement with the forks 11 of the coupling bridge 9,

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which surfaces cooperate with corresponding parallel guiding surfaces of the forks 11 for the cutter assembly 2, thereby permitting quick and easy adjustment of the desired shaving zone.

An alternative solution in respect of the manufacture and configuration of the cylindrical cutter assembly is shown in FIG. 4. In this Figure, the metal-plastic carrier 15' of the cutter assembly 2' is composed of a metallic core 13' configured as a profiled bar and of a cylindrical plastic body 14' intimately connected therewith. The individual cutter blades 3 are seated on the metal-plastic carrier 15' constructed in this manner, having their inner or perforated edges 16 in abutment with the ribs 20 of the profiled metallic core 13' and bearing thereagainst.

The cylindrical cutter assembly 2' configured in this manner is equally manufactured by injection molding, in which process the metallic core 13' configured as a profiled bar is centered in a mold, whereupon the plastic molding material forming the plastic body 14' flows through the longitudinal grooves 21 of the metal core 13' which in this embodiment is triangular, thereby providing, as in the example previously described, an intimate connection between the core and the plastic body 14' surrounding it on all sides and the cutter blades 3 seated directly on the core 13'. In this arrangement, the cutter blades 3 are self-centering on the profiled core 13' of the metal-plastic carrier 15'.

FIG. 5 finally shows another alternative form of a cutter assembly of the invention. In this Figure, the metallic core 13" of the metal-plastic carrier 15" is formed of a tube having on its circumference annular grooves 22 spaced at regular intervals for insertion and positioning of the individual cutter blades 3 of the cutter assembly 2". The metallic core 13" has the material of the plastic body 14" molded around it completely, that is, it is embedded therein and forms a compact body therewith, viz., the metal-plastic carrier 15" for the cutter blades 3 of the cutter assembly 2". In this arrangement, the cutter blades 3 have bores or recesses 23 invariably arranged at the same level and penetrated in the manufacturing process by the still liquid plastic material of the plastic body 14", as a result of which the cutter blades, in addition to being permanently secured in position in the core 13" of the cutter assembly 2", are anchored in the plastic body 14" in particularly solid and positionally accurate fashion.

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It is within the scope of the present invention to provide the profiled bar or tube forming the metallic core of the cutter assembly with a polygonal, for example, tetragonal or hexagonal profile, which has the advantage of enabling the entire cutter assembly to be adjusted to a variety of predetermined positions to allow the use of several circumferential areas of the cutter blades, this being accomplished by turning and inserting the cutter assembly within correspondingly formed recesses in the coupling means 8 carrying the cutter assembly.

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Patent Claims:

1. A cutter assembly (2, 2', 2'') for dry shaving apparatus, including cutter blades (3) of circular circumference arranged on a carrier transversely to its longitudinal axis (y), characterized in that the cutter blades (3) are received by a cylindrical metal-plastic carrier (15, 15', 15'') comprising a metallic core (13, 13', 13'') and a cylindrical plastic body (14, 14', 14'') encasing it closely and forming a compact unit therewith.

2. A cutter assembly as claimed in claim 1, characterized in that the cutter blades (3) are anchored in the metallic core (13'') of the metal-plastic carrier (15'') by retaining means (grooves 22) arranged on the core circumference at predetermined relative distances.

3. A cutter assembly as claimed in claim 1, characterized in that the cutter blades (3) have their concentric inner edges (16) directly seated on the metallic core (13) of the metal-plastic carrier (15) and are positioned thereon in a mold serving for the manufacture of the cutter assembly (2) before the material forming the plastic body (14) is injection-molded around the core (13).

4. A cutter assembly as claimed in claim 1, 2 or 3, characterized in that the cutter blades (3) are provided with preferably cloverleaf cutouts (17) arranged symmetrically to their concentric inner edges (16).

5. A cutter assembly as claimed in claim 1, 2 or 3, characterized in that the metallic core (13') is configured as a profiled bar of polygonal cross section having longitudinal grooves (21) throughout its length, its ribs (20) corresponding with the inner edges (16) of the cutter blades (3).

6. A cutter assembly as claimed in claim 1, 2 and 4, characterized in that the metallic core (13'') of the cutter assembly (2'') is formed of a tube having on its circumferential surface equidistantly spaced annular mounting grooves (22) for insertion and positioning of the individual cutter blades (3).

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7. A cutter assembly as claimed in claim 6, characterized in that the cutter blades (3) positioned in, and located in positive engagement with, the mounting grooves (22) provided on the circumferential surface of the tubular metallic core (13") have openings (23) which in the mold are penetrated by the still liquid material of the plastic body (14") encasing said tube.

8. A cutter assembly as claimed in at least one of the preceding claims, characterized in that the metallic core (13, 13') is manufactured in the mold after the injection-molding process by being pressed into the plastic body (14, 14') having a concentric axial bore.

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List of References:

- 1 Shaving Head
- 2, 2', 2" Cutter Assembly
- 3 Cutter Blades
- 4 Shaving Foil
- 5 Shaving Head Frame
- 6 Casing
- 7 Oscillating Lever
- 8 Coupling Means
- 9 Coupling Bridge
- 10 Collar
- 11 Fork-shaped Ends of 9
- 12 Compression Spring
- 13, 13', Core
- 13" 13"
- 14, 14', Plastic Body
- 14" 14"
- 15, 15', Metal-Plastic Carrier composed of 13 and 14
- 15" 15"
- 16 Perforated Edges
- 17 Cloverleaf Cutouts
- 18 Thumbholes
- 19 Centering Surfaces
- 20 Ribs
- 21 Longitudinal Grooves
- 22 Grooves
- 23 Openings
- y Longitudinal Axis of 2