

PATENT SPECIFICATION

(11) 1311985

DRAWINGS ATTACHED

- (21) Application No. 38458/70 (22) Filed 10 Aug. 1970
 (31) Convention Application No. 59350 (32) Filed 26 Aug. 1969 in
 (33) Luxemburg (LU)
 (44) Complete Specification published 28 March 1973
 (51) International Classification B26B 19/04
 (52) Index at acceptance B4B 41



(54) CUTTING HEAD FOR DRY SHAVERS

(71) We, BRAUN AKTIEN-GESELLSCHAFT, a German Body Corporate, of 22 Russelsheimer Strasse, 6 Frankfurt/Main, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a cutting head for a dry shaver including a cutting foil or outer cutting element which for the passage of hairs possesses a multiplicity of apertures of at least two different kinds.

Fundamentally, the attempt is invariably made to form the cutting foil as thin as the requirements for strength will allow, so that the hairs can be cut off at as short a length as possible. On the other hand, in order to accommodate as many apertures as possible in a given field of perforations, the bridges of material which separate the individual apertures from each other will be made as small in width as possible; for reasons of strength, however, especially in the case of very thin foils, the bridges must not be of less than a certain width. Finally, fundamentally an effort is made to maintain the smallest possible width over the entire length of the bridges, since even only a local widening of the bridges impairs the "aperture ratio", this term being herein used to refer to the ratio between the overall area taken up by the apertures admitting hairs and the overall area of the bridges, within the perforated field.

On the other hand, another aim is for the widest possible apertures. The largest possible width of an aperture is, however, limited by the fact that the skin may be allowed to bulge only so far through the apertures that it is not irritated or even gashed by the inner cutting element. This dimension of the apertures is limited according to the configuration of the apertures and the thickness of the cutter foil.

Configurations of apertures have become known in the most varied shapes and versions, which can be categorised into two kinds which may be basically distinguished in respect of their characteristics; one kind, hereinafter des-

ignated "holes", are of circular or of approximately circular, regular polygonal, triangular or square shape, hence are approximately equally dimensioned in different directions; this is the configuration most favourable for the uniform penetration of short hairs entering from all directions.

The other kind of aperture is obviously larger in one dimension than in the dimension directed transversely to it; such apertures, when they are longer in one direction than the other, are suitable in the direction of their longitudinal extent for seizing longer hairs; hereinafter they will be designated "slots".

Experience has shown that perforated fields occupied only by circular holes do not infallibly seize the longer hairs and that perforated fields provided solely with slots either do not adequately obviate irritations to the skin or, if this drawback has been obviated by a reduction in the width of the slot, result in a bad shaving performance.

Since both types of aperture have advantages which are mutually exclusive, in the hope of preserving their advantages but of avoiding their drawbacks the attempt has been made to accommodate both types of aperture in one upper cutting foil, to which end the perforated field was divided into zones or tracts to each of which a certain shape of aperture was allotted. It emerged, however, that no advantage was realised: the areas of the perforated field that were available for the individual types of aperture were too small to be effective, and the aperture ratio of the perforated field overall had become so poor, merely by reason of the transitional regions, that the shaving performance was appreciably reduced in comparison with a perforated field of uniform character.

Recently an arrangement became known in which lozenge-shaped slots are arranged in various directions, while a good aperture ratio is maintained. In connection with the said perforated field, which consists solely of slots and to which the inherent disadvantages of this type of perforated field attach, the proposal has been made that, by omitting a proportion

of the intervening bridges to combine each trio of lozenge-shaped apertures into a six-sided hole, a perforated field should be created which consists of slot-shaped and of approximately circular apertures.

In a perforated field corresponding to this proposal the slot-type apertures perforce no longer possess the characteristics sought after; they cannot be regarded as slots accepting long hairs, since in respect of their greatest length they have to be shorter than the holes arising from three of the apertures and accordingly are no longer even suitable for seizing on short hairs. The problem of combining a hole and a slot in a common perforated field has up to now, therefore, been neither posed nor solved.

This problem lies at the basis of the present invention, the aim of which is to provide solutions which are also realisable in practice.

The invention is not only aimed at combining both types of aperture in one perforated field so that long and short hairs may be shaved off at one stroke, but at the same time it opens up the possibility of seizing hold of longer hairs lying in different directions without irritation to the skin occurring and without any need to renounce an optimum aperture ratio.

At the basis of the invention is a recognition of the fact that the width of the slots whose task is limited to capturing the hairs (which experience shows are but few) that have not been seized by the holes, can be selected to be sufficiently small to be tolerable to the skin by means of a local combination with holes for short hairs.

Making use of this fact, the present invention provides a cutting head for a dry shaver, having a cutting foil or outer cutting element provided with a plurality of apertures for the passage of hair, the apertures being separated from one another by bridges of material and being in the form of holes and slots as hereinbefore defined, wherein the holes and slots are arranged intermixed with and adjacent to each other over at least the central part of the area of the cutting foil, at most two holes being immediately adjacent each other in any part of the foil or element, and the length of each slot being greater than, or equal to, the maximum width of each hole.

A cutting foil formed in this way seizes normal stubble and allows it to pass through the holes. The latter may be circular, but it is preferable that they should be constituted as polygons, because the latter, especially in combination with slots, result in a more favourable aperture ratio and facilitate better cutting angles than do circular apertures.

To put the invention into effect, figures having corner-angles ranging in number from three to six are available. Figures with a higher number of corner-angles approach the circular

hole so closely that the aperture ratio and the shaving performance deteriorate.

With a view to achieving a more favourable aperture arrangement, it is preferable to provide the cutting area with only one type of hole. However, holes with a differing number of edges may also be arranged in the same cutting area. Finally, variously formed slots may also be arranged with each other and with holes in the same cutting area.

In this context an advantageous arrangement is one in which the holes have at least five sides and the slots are arranged adjacent said sides and substantially parallel thereto to give a rosette-like appearance to each hole and associated slots, so that the slots can also seize tangled hairs.

According to another arrangement of the invention the holes are arranged in pairs, slots being omitted between adjacent holes of each pair. With this arrangement the number of slots will admittedly be limited, but the aim of the invention will be fulfilled although not necessarily in optimum fashion.

The more closely the limiting line around the holes approximates to a straight line, the better the overall aperture ratio of the perforated field can be made, as a rule. The type and size of the bridges between the individual apertures are decisive as regards the size of the effective area made up of apertures. It is admittedly of advantage if the slots have edges running parallel to each other, because then a favourable aperture ratio is arrived at, but other solutions are also possible in order to achieve progress relative to already known perforated fields not combining mixed shapes of aperture.

As stated, the effective length of the slots should be greater than the width of the holes in any direction in order that they may fulfil their task of seizing the long hairs. According to a further arrangement of the invention all the holes have substantially the same size and all the slots have substantially the same size, the length of each slot being equal to the total of the length of the adjacent edge of a hole and the width, measured along a line parallel to the said edge of the hole, of the slot and of the bridge between the hole and slot. It is, however, also possible to have slots of unequal size.

Thus, according to another arrangement of the invention all of the holes have substantially the same size, some of the slots have a length which is equal to the total of the length of the adjacent edge of a hole and the width, measured along a line parallel to the said edge of the hole, of the slot and of the bridge between the hole and slot and the remainder of the slots have a length which is equal to the total of the length of the adjacent edge of a hole and twice the width, measured along a line parallel to the said edge of the hole,

of the slot and of the bridge between the hole and the slot.

As regards the cutting performance and the ability to seize on hairs from a whorl of growth and to capture the long hairs, there is preferably provided a basic form of hole comprising a substantially hexagonal hole and each hole is preferably surrounded by six slots, each edge of each slot extending substantially parallel to an edge of the hexagonal hole.

In this embodiment the slots may take the form of parallelograms and may be arranged relatively to the holes in such a manner that the small sides of the slots, separated from the holes by an intervening bridge, are in alignment with the respective parallel edges of the hexagonal holes which run obliquely to the respective slots.

The hexagonal hole, which has particularly proved its value in practice in simple perforated fields because of the favourable aperture ratio and has been known for years, is especially well suited for realising the invention.

In order to be able to seize particularly long hairs, which always remain in isolation uncut especially during negligent and hastily-performed shaving, it is possible, without having to alter any feature in the arrangement of the holes, to provide an arrangement whereby slots of greater length are relatively few in number compared to slots of lesser length and their lengths extend in at least two directions at an angle to each other.

Good results may also be achieved with square-shaped holes. It is this form of hole, especially, which makes it possible to associate slots with a pair of holes in such a way that there is a slot arranged between each pair of holes. By this means relatively lengthy slots may be provided without having to alter anything as regards the form and size of the hole within the cutting area.

The triangle as a form of hole is equally suitable for putting the invention into practice. This form of hole indeed offers itself for the employment of hole edges of the kind which deviate from a straight line. This results in a perforated field pattern in which the slots have narrower sections in the centre of their longitudinal extent and some widening towards their ends, with the consequence that the slots may be long without irritations to the skin occurring, and the slots have regions adjacent their ends which are so wide that the hairs are especially effectively caught in them.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which.—

Figure 1 shows the cutting head of a shaver; Figure 2 shows a cutting foil from in front; Figure 3 is an enlargement taken from Figure 2 which, like the following Figures, illustrates a section of the foil;

Figure 4 illustrates a cutting area with

square holes which are combined with slots of equal length;

Figure 5 shows a cutting area according to Figure 4, but in which slots are associated with each pair of holes;

Figure 6 shows a cutting area with hexagonal holes and slots of equal length;

Figure 7 shows a cutting area with hexagonal holes and slots of unequal length, and

Figure 8 illustrates a cutting area with generally triangular holes.

In Figure 1 is shown a cutting head 8 in which the cutting foil 1 is arranged to be stretched in a conventional manner over an inner cutter block 9 carrying cutters. The cutters 9 are of blade type and are arranged in the direction of the line 90 (Figure 2) and are consequently obliquely directed. This arrangement is to be recommended particularly in the case of the perforated field shown in Figure 4.

The cutting foil 1 illustrated in Figure 2 is provided with a uniform perforated field or cutting area 2 of which the part 3 marked by a circle is illustrated in various possible forms on an enlarged scale in Figures 4 to 8. Fastening means are designated 4.

Within the scope of the invention it is possible to position the cutters in an oblique manner as is indicated by the line 90 in Figure 2, or to employ cutters of corrugated pattern.

Further, the invention is not confined to the external shape of the cutting foil shown in Figures 1 and 2; it may also be employed, for example, in the case of circular perforated foils or the like.

In the example of an embodiment in Figure 4 square holes 20 are shown whose edges 201 to 204 are formed as straight lines. Each of the said edges, separated only by an appropriate bridge 25 to 28, has adjacent to it a longitudinal slot, 21 to 24, whose edges are likewise formed as straight lines. Since the corresponding adjacent edges of the aperture extend parallel to each other, the result inevitably consists in intervening bridges 25 to 28 having uniform width. Thus the bridge 25 is formed by the two edges 201, 211, the bridge 26 by the two edges 202, 212, the bridge 27 by the two edges 203, 213, and the bridge 28 by the edges 204, 214.

The slots 21 to 24 are arranged in a counter-clockwise manner around the hole 20 enclosed by them, the slot 21 being longer by the width 220 of the slot 22 and by the width of the bridge 26 than the edge 201 of the hole 20, and consequently also longer than the transverse dimension of the hole. Since the holes are arranged symmetrically, this also applies to the slots 22 to 24; the widths 210, 220, 230 and 240 therefore equate to each other; similarly all the bridges 25 to 28 are of equal width. By having a square as the form of the hole, in the arrangement of apertures

here illustrated slots are obtained in two directions at an angle to each other, so that tangled groups of hair can be very well dealt with by this combination of apertures.

5 With the assistance of the square hole in Figure 5 there is an example of how perforated fields may be constituted in which a hole and a slot are combined together, and indeed are combined in a regular fashion, but in which
10 a slot is not always arranged between every two holes.

The two holes 30 and 300 are united to form pairs of holes, i.e. they are separated from each other merely by the intervening bridge 39. The pair are surrounded by the slots 31 to 34, and between the two kinds of aperture are situated the bridges 35 to 38.

This arrangement has the advantage that on the same perforated field more holes 30, 300
20 can be accommodated than on the perforated field in Figure 4; furthermore, the slots 32, 34 are longer, so that this cutter foil can also seize very long hairs. In this solution too the result comprises slots positioned in two directions at an angle to each other.

In the drawing the holes of a pair are arranged one above the other, i.e. the pairs are situated in the row marked 6; in column 60, between each hole there is arranged a slot. In order that the long slots should be present
30 which extend in a second direction, in another perforated zone the pair of holes may be positioned in the column marked 60, and the long slots will then likewise be in the column.

In Figure 6 is illustrated a perforated field according to the enlargement 3 in Figure 3. All the holes 40 are formed as hexagons the maximum width of which is shorter than the longer diagonal of the slots. Adjacent to each
40 edge of each hexagon there is arranged an appropriate slot 41 to 46; both of these kinds of aperture are separated by the bridges 401 to 406. This arrangement gives each hole and its associated slots a rosette-like appearance as can be seen from Figure 6.

It is obvious that the hexagon will result in slot-type positions in three directions at an angle to each other. In this case also bridges 401 to 406 of equal length and of equal and
50 constant width will be achieved, so that not only is the seizing of long hairs possible in every position, but a highly favourable aperture ratio may be obtained.

In Figure 7 the example of the embodiment in Figure 6 is altered to the extent that in Figure 6 slots of equal length 41 to 46 are shown, and in Figure 7 the possibility is indicated that particularly long slots 47, distributed over the hexagonally perforated field, may be arranged. Even if in this embodiment small apertures 48 are made which are scarcely suited to the cutting of hairs, and consequently the aperture ratio undergoes a deterioration, such a formation, which does not destroy the regularity of the perforated field, is feasible
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since it makes it possible to have particularly lengthy slots.

Just as holes with straight edges according to the basic solution provided by the invention may be combined with slots, it is also possible to combine holes having arched edges with slots.

This is shown in Figure 8, with the assistance of generally triangular holes 50 whose edges 500 are formed as arcs which are of a larger radius than the circle circumscribed around the corners of the triangle. The greater this radius, the more the arc will approximate to a straight line.

The shape of the slot arising in this design of hole deviates from the rectangle or parallelogram; even a constant width of slot is not attainable if the bridges 54 to 56 are to have a constant width, a feature to be aimed for in any event because of the more favourable aperture ratio.

Nevertheless the slots 51 to 53 are not unfavourable; on the contrary they are favourable; they are particularly long, and so they can seize long hairs. In the centre of their longitudinal dimension they are constricted, since by reason of the curvingly arranged edges of the holes they undergo narrowing there, and so the skin cannot penetrate; irritations to the skin, which otherwise cannot be avoided in the presence of very long slots, are therefore eliminated in this case; on the other hand, the slots widen out towards either end, so that at that location long hairs can be caught particularly effectively.

WHAT WE CLAIM IS:—

1. A cutting head for a dry shaver, having a cutting foil or outer cutting element provided with a plurality of apertures for the passage of hair, the apertures being separated from one another by bridges of material and being in the form of holes and slots as hereinbefore defined, wherein the holes and slots are arranged intermixed with and adjacent to each other over at least the central part of the area of the cutting foil, at most two holes being immediately adjacent each other in any part of the foil or element, and the length of each slot being greater than, or equal to, the maximum width of each hole.

2. A cutting head according to claim 1, wherein the holes are polygonal and wherein the longitudinal edge of each slot extends substantially parallel to the adjacent edge of the associated hole.

3. A cutting head according to claim 2, wherein a slot is provided adjacent each edge of each hole.

4. A cutting head according to claim 2 or claim 3, wherein all the holes have substantially the same size and all the slots have substantially the same size, the length of each slot being equal to the total of the length of the adjacent edge of a hole and the width, measured along a line parallel to the said edge

here illustrated slots are obtained in two directions at an angle to each other, so that tangled groups of hair can be very well dealt with by this combination of apertures.

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15 bridge 39. The pair are surrounded by the slots 31 to 34, and between the two kinds of aperture are situated the bridges 35 to 38.

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This is shown in Figure 8, with the assistance of generally triangular holes 50 whose edges 500 are formed as arcs which are of
75 a larger radius than the circle circumscribed around the corners of the triangle. The greater this radius, the more the arc will approximate to a straight line.

The shape of the slot arising in this design of hole deviates from the rectangle or parallelogram; even a constant width of slot is not
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85

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95 skin, which otherwise cannot be avoided in the presence of very long slots, are therefore eliminated in this case; on the other hand, the slots widen out towards either end, so that at that location long hairs can be caught particularly
100 effectively.

WHAT WE CLAIM IS:—

1. A cutting head for a dry shaver, having a cutting foil or outer cutting element provided with a plurality of apertures for the passage
105 of hair, the apertures being separated from one another by bridges of material and being in the form of holes and slots as hereinbefore defined, wherein the holes and slots are arranged
110 intermixed with and adjacent to each other over at least the central part of the area of the cutting foil, at most two holes being immediately adjacent each other in any part of the foil or element, and the length of each slot
115 being greater than, or equal to, the maximum width of each hole.

2. A cutting head according to claim 1, wherein the holes are polygonal and wherein the longitudinal edge of each slot extends substantially parallel to the adjacent edge of the
120 associated hole.

3. A cutting head according to claim 2, wherein a slot is provided adjacent each edge of each hole.

4. A cutting head according to claim 2 or claim 3, wherein all the holes have substantially the same size and all the slots have substantially the same size, the length of each slot
125 being equal to the total of the length of the adjacent edge of a hole and the width, measured along a line parallel to the said edge
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of the hole, of the slot and of the bridge between the hole and slot.

5 5. A cutting head according to any one of claims 2 to 4 wherein the holes have at least five sides and the slots are arranged adjacent said sides and substantially parallel thereto to give a rosette-like appearance to each hole and associated slots.

10 6. A cutting head according to any one of claims 2 to 4, wherein the holes are substantially hexagonal and each hole is surrounded by six slots, each edge of each slot extending substantially parallel to an edge of the hexagonal hole.

15 7. A cutting head according to claim 6, wherein the slots take the form of parallelograms and are arranged relatively to holes in such a manner that the small sides of the slots, separated from the holes by an intervening bridge, are in alignment with the respective parallel edges of the hexagonal holes which run obliquely to the respective slots.

20 8. A cutting head according to claim 2 or claim 3, wherein all of the holes have substantially the same size, some of the slots have a length which is equal to the total of the length of the adjacent edge of a hole and the width, measured along a line parallel to the said edge of the hole, of the slot and of the bridge between the hole and slot, and the remainder of the slots have a length which is equal to the total of the length of the adjacent edge of a hole and twice the width, measured along a line parallel to the said edge of the hole, of the slot and of the bridge between the hole and the slot.

9. A cutting head according to claim 8, wherein the slots of greater length are relatively few in number compared to slots of lesser length and their lengths extend in at least two directions at an angle to each other.

10. A cutting head according to claim 1 or claim 2, wherein the holes are arranged in pairs, slots being omitted between adjacent holes of each pair.

11. A cutting head according to any one of claims 2 to 4 or 8 to 10, wherein the holes are formed as squares and the slots as rectangles.

12. A cutting head according to any one of claims 2 to 11, wherein all the edge of the holes and slots are formed as straight lines.

13. A cutting head according to claim 1, wherein the holes are of generally triangular form.

14. A cutting head according to claim 13, wherein the edges of the holes and slots run in arcs.

15. A cutting head for a dry shaver substantially as hereinbefore described with reference to Figures 1 and 2 or any one of Figures 3 to 8 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1973.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.



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