

SPECIFICATION

Shaving Head for a Dry-Shaving Apparatus

5 The invention relates to a shaving head for a dry-shaving apparatus, comprising a stationary shear plate formed with hair-entry apertures, and a movable cutting unit which cooperates with the shear plate and comprises a plurality of hair-cutting blades each having a surface which is in sliding contact with the shear plate, and a plurality of hair-pulling blades each arranged in front of an associated one of the hair-cutting blades with respect to the direction of the cutting movement thereof and having a surface which is arranged for sliding contact with the shear plate, the hair-pulling blades being movable with the hair-cutting blades over the hair-entry apertures of the shear plate in the operation of the shaving head and each hair-pulling blade being movable relative to the associated hair-cutting blade away from and towards the shear plate.

A shaving apparatus having a shaving head of this construction is described in our prior Patent Specification No 1,467,557. In this known construction the sliding surfaces of the hair-pulling blades are flush with the sliding surfaces of the hair-cutting blades not only in the assembled condition of the shaving head, when the sliding surfaces of both sets of blades are in contact with the shear plate. In carrying out their hair-pulling function the hair-pulling blades move relative to the hair-cutting blades away from the shear plate and then reseal into contact with the plate again. If the construction were such, due to manufacturing tolerances, for example, that without the restraint imposed by the shear plate one of the hair-pulling blades could reseal to a position in which its sliding surface projected beyond that of the associated hair-cutting blade, the situation might arise, depending upon the size and shape of the hair-entry apertures, in which this hair-pulling blade could enter a hair-entry aperture when the shaving apparatus is in operation, with disastrous results.

45 According to the invention there is provided a shaving head for a dry-shaving apparatus, comprising a stationary shear plate formed with hair-entry apertures, and a movable cutting unit which cooperates with the shear plate and comprises a plurality of hair-cutting blades each having a surface which is in sliding contact with the shear plate, and a plurality of hair-pulling blades each arranged in front of an associated one of the hair-cutting blades with respect to the direction of the cutting movement thereof and having a surface which is in sliding contact with the shear plate, the hair-pulling blades being movable with the hair-cutting blades over the hair-entry apertures of the shear plate in the operation of the shaving head and each hair-pulling blade being movable relative to the associated hair-cutting blade away from and towards the shear plate, wherein the shape and dimensions of the sliding surface of each hair-pulling blade are such that in every position of the blade in which the sliding surface thereof extends over a hair-entry

aperture, a portion of said surface is in contact with a part of the shear plate adjacent that aperture.

In one embodiment of the invention the hair-entry apertures are in the form of slots each extending transversely of the direction of movement of the hair-cutting and hair-pulling blades over the shear plate, and the sliding surface of each hair-pulling blade comprises an elongate first part which extends transversely of said direction and a second part which extends rearwardly or forwardly from the first part with respect to said direction.

The invention also provides a cutting unit for a shaving heading according to the invention.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which

Figure 1 is an elevation of a dry-shaving apparatus having three rotary shaving heads each constructed in accordance with the invention,

Figure 2 is an elevation of this apparatus viewed at right angles to *Figure 1* and showing one of the shaving heads and the associated driving means in cross-section, the section being taken on the line II-II of *Figure 1*.

Figure 3 is an enlarged perspective view of one of the shaving heads of the shaving apparatus of *Figure 1* and 2,

Figure 4 is a diagrammatic view of the sliding surfaces of a hair-cutting blade and associated hair-pulling blade of the shaving head of *Figure 3*,

Figures 5 to 9 are diagrammatic views similar to *Figure 4*, showing several possible variants of the shape of the sliding surface of the hair-pulling blades, and

Figures 10 and 11 are diagrammatic side views, drawn to a greatly enlarged scale, of portions of a hair-cutting blade and the associated hair-pulling blade and of the associated shear plate, illustrating the operation of the hair-pulling blade.

The shaving apparatus shown in *Figures 1* and 2 comprises a housing 1 on which is mounted a shear-plate holder 2 for three stationary shear plates 3. The shear plates 3 are of circular form and have hair-entry apertures in the form of slots 4.

A rotary cutting unit 5 (*Figure 2*) is disposed on the inner side of each shear plate 3 for cooperation therewith. The cutting units 5 of which one is shown schematically in *Figure 2*, each comprise a plurality of hair-cutting blades and a plurality of hair-pulling blades, as will be described later herein with reference to *Figure 3*.

The cutting units are rotated relative to the shear plates by an electric motor 10 to which each cutting unit is coupled by an associated hollow spindle 6 (*Figure 2*) and gear wheel 7 and a gear wheel 8 fixed on the shaft 9 of the motor 10. The gear wheels 7 are each rotatably journaled on an associated spindle 11 which is mounted in a mounting plate 12. The gear wheel 7 has a cavity 13 which is closed by a cover plate 14. This cavity accommodates a flange 15 formed at the end of the hollow spindle 6. The flange 15 has a non-circular, for example, square, shape and the cavity 13 is shaped accordingly, so that a coupling is obtained for the transmission of the rotary movement of the gear

wheel 7 to the spindle 6. A coil spring 16, which for the greater part is disposed in the hollow spindle 6, and which is compressed between an end wall of the hollow spindle 6 and an end wall of the recess

- 5 13 in the gear wheel 7, exerts a force on the spindle 6 in the direction of the cutting unit 5. A conical portion 17 of the spindle 6 bears against the cutting unit 5 to transmit this force to the cutting unit and via the cutting unit to the shear plate 3, so that a
- 10 flange 18 around the periphery of the shear plate is pressed against the shear plate holder 2. During use of the shaving apparatus, the shear plates 3, together with the associated cutting units 5 and spindles 6, can be pressed inwards against the ac-
- 15 tion of the springs 16 under the pressure with which the shear plates are held against the user's skin.

A coupling for the transmission of the rotary movement of each spindle 6 to the associated cutting unit 5 is formed by an end portion 19 of the spindle 6 of substantially rectangular cross-section engaging in a central coupling aperture 20 of corresponding shape in the cutting unit 5.

- The cutting units of all three shaving heads of the
- 25 apparatus of Figures 1 and 2 are coupled to the electric motor in the above manner, the three gear-wheels 7 meshing with the one centrally disposed gear wheel 8 of the motor shaft 9.

- As is shown in Figure 3, each cutting unit 5 comprises a cutting member 21 which is constituted by a central body 22 on which is formed a plurality of hair-cutting blades 23, which are evenly distributed around the periphery of the body 22. The coupling aperture 20 is formed in the central body 22. As
- 35 shown in Figures 10 and 11, each hair-cutting blade 23 has at its front (with respect to the direction of movement of the blade) a sloping surface 37 which forms an acute angle α with a surface 26 of the blade which is in sliding contact with the inner side
- 40 28 of the respective shear plate 3. The edge 39 at which the surfaces 37 and 26 meet is the cutting edge of the hair-cutting blade and the angle α is the cutting angle. In the operation of the shaving apparatus the sliding surface 26 of each hair-
- 45 cutting blade travels over the hair-entry slots 4 in the respective shear plate and the cutting edge 39 of the blade, in cooperation with the edges of the shear plate at the boundaries of the slots, severs the hairs which protrude through the slots.

- 50 Each cutting unit 5 also comprises a plurality of hair-pulling blades 24 which are manufactured from a resilient sheet material and which are slidably arranged one on the front surface 37 of each hair-cutting blade 23. The hair-pulling blades 24 are integral with a central annular portion 25 which is secured to the central body 22 of the respective cutting member 21 by, for example, spot-welding or an adhesive. The hair-cutting blades 24 thus travel
- 55 round with the hair-cutting blades 23 in the operation of the apparatus. Each hair-pulling blade has a surface 27 which is arranged for sliding contact with the inner side 28 of the respective shear plate in front of the sliding surface 26 of the associated hair-cutting blade 23. The edge 36 of each hair-
- 60 pulling blade at which the sliding surface 27 of the

blade meets the front surface thereof is the leading edge of the blade in the movement of the blade over the shear plate, the two surfaces forming an acute angle at this edge.

- 70 As can be seen in Figure 3, the hair-pulling blades 24 have an elongate shape similar to that of the hair-cutting blades 24, the sliding surfaces 27 and 38 being formed on the distal ends of the blades, and the length of the hair-pulling blades is slightly greater than the length of the hair-cutting
- 75 blades so that, at least when the cutting unit 5 and associated shear plate 3 are assembled, the parts 29 of the hair-pulling blades adjacent the annular portion 25 are spaced from the parts 30 of the hair-cutting blades adjacent the central body 22. Owing to the elastic properties of the material from which the hair-pulling blades 24 are manufactured, these blades are movable relative to the associated hair-
- 80 cutting blades towards and away from the shear plate and are urged by the elasticity into sliding contact with the inner side of the shear plate. In order to prevent the hair-pulling blades 24 from being pressed into the hair-entry slots 4, each of these blades, in the construction shown in Figure 3
- 85 and Figure 4, is formed at its distal end with an ear 31 which is bent rearwardly with respect to the direction of movement of the blade over the shear plate and which has a surface 32 arranged for sliding contact with the inner side of the shear plate. As
- 90 can be seen in Figure 4, the surface 32 and the surface 27 of each hair-pulling blade together form an L-shaped sliding surface 27, 32 of such dimensions that in every position of the blade in which this sliding surface extends over a hair-entry slot 4 of the
- 95 shear plate, part of the surface 27, 32 is in contact with the inner side of the shear plate adjacent that slot. Thus, at no time does the sliding surface 27, 32 of a hair-pulling blade lie wholly within the projected boundary of a hair-entry slot, i.e., the projection of the boundary at right angles to the plane of the part of the shear plate in which the slot is
- 100 formed.

- Figures 5 and 9 are views similar to Figure 4 showing a number of possible variants of the shape of the sliding surface of the hair-pulling
- 110 blades 24. In each figure the boundaries of the sliding surfaces of a hair-cutting blade 23 and a hair-pulling blade 24 are shown in full lines and the boundary of a hair-entry slot 4 in broken lines. The ear 31 on the hair-pulling blade 24 in Figure 4, the two ears 33 on the blade 24 in Figure 5 and the L-shaped ear 34 on the blade 24 in Figure 6 serve also in each case as means for guiding the hair-pulling
- 115 blade 24 in its movement relative to the associated hair-cutting blade 23. Figure 6 shows an L-shaped sliding surface of the hair-pulling blade in which the shorter limb of the L projects forwardly instead of rearwardly as in Figure 4.

- Figures 10 and 11 illustrate the operation of a
- 125 hair-pulling blade. When a hair 35 is caught in a hair-entry slot 4, the leading edge 36 of hair-pulling blade 24, moving in the direction of arrow P, will contact the hair at location A on the hair. The edge 36 has a sharpness such that it will slightly penetrate the hair 35 at A without severing it. A reaction
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force is exerted on the hair-pulling blade 24 by the hair 25 in a direction opposite to the direction of movement P of the blade. This force will be counteracted by the component N_1 of the normal force N which is exerted on the hair-pulling blade 24 by the front surface 37 of the associated hair-cutting blade 23 (Figure 10). For the sake of simplicity the slight frictional forces between the two blades have been neglected. The component N_2 of the normal force N will cause the hair-pulling blade 24 to slide along the surface 37 of the hair-cutting blade, away from the shear plate 3.

Owing to, *inter alia*, the natural elasticity of the user's skin, the hair 35 will be pulled up from the skin by the blade 24 until the cutting edge 39 of the hair-cutting blade 23 reaches the hair at location B thereon (Figure 11). The hair is then severed by the cutting blade 23 in cooperation with the shear plate 3. Thus, a length of the hair 35 is cut off which is longer than the length which would but cut off without the aid of the hair-pulling blade by an amount equal to the distance between A and B, so that a closer shave is obtained.

CLAIMS

1. A shaving head for a dry-shaving apparatus, comprising a stationary shear plate formed with hair-entry apertures, and a movable cutting unit which cooperates with the shear plate and comprises a plurality of hair-cutting blades each having a surface which is in sliding contact with the shear plate, and a plurality of hair-pulling blades each arranged in front of an associated one of the hair-cutting blades with respect to the direction of the cutting movement thereof and having a surface which is arranged for sliding contact with the shear plate, the hair-pulling blades being movable with the hair-cutting blades over the hair-entry apertures of the shear plate in the operation of the shaving head and each hair-pulling blade being movable relative to the associated hair-cutting blade away from and towards the shear plate, wherein the shape and dimensions of the sliding surface of each hair-pulling blade are such that in every position of the blade in which the sliding surface thereof extends over a hair-entry aperture, a portion of said surface is in contact with a part of the shear plate adjacent that aperture.

2. A shaving head as claimed in Claim 1, wherein the hair-entry apertures are in the form of slots each extending transversely of the direction of movement of the hair-cutting and hair-pulling blades over the shear plate, and wherein the sliding surface of each hair-pulling blade comprises an elongate first part which extends transversely of said direction and a second part which extends rearwardly or forwardly from the first part with respect to said direction.

3. A shaving head for a dry-shaving apparatus, substantially as herein described with reference to Figures 1, 2, 3, 4, 10 and 11 or any of Figures 2 to 9 of the accompanying drawings.

4. A cutting unit for a shaving head as claimed

in Claim 1, 2 or 3.

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2. A shaving head as claimed in Claim 1, wherein the hair-entry apertures are in the form of slots each extending transversely of the direction of movement of the hair-cutting and hair-pulling blades over the shear plate, and wherein the sliding surface of each hair-pulling blade comprises an elongate first part which extends transversely of said direction and a second part which extends rearwardly or forwardly from the first part with respect to said direction.

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