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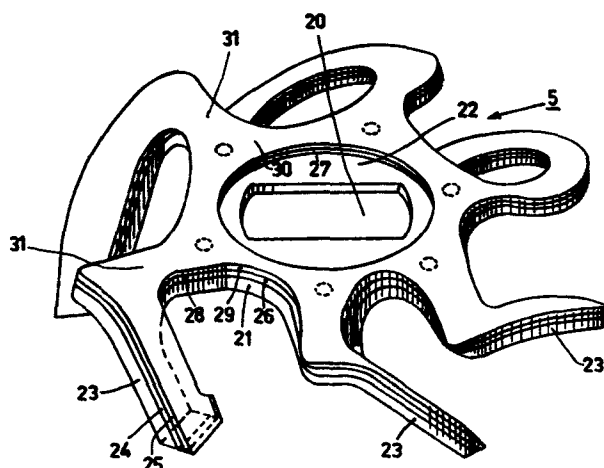
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⑤④ Shaving apparatus and cutting unit therefor.

⑤⑦ The invention relates to a shaving apparatus comprising a drivable cutting unit with cutters, each cutter being equipped with a lead cutter which leads in the direction of driving and which is movable relative to the cutter. The lead cutters serve to slightly pull the hairs, so that a better shaving result can be obtained. The distance over which the hairs can be moved is limited by the shape and dimensions of the cutter and the lead cutter and by the properties of the hairs and the skin. It is the object of the invention to eliminate this restriction and this leads to a construction in accordance with which each cutter, in addition to the said first lead cutter, is equipped with a second lead cutter which leads relative to the first lead cutter and which second lead cutter is movable relative to the first lead cutter.



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Shaving apparatus.

The invention relates to a shaving apparatus comprising a drivable cutting unit with cutters, each cutter being equipped with a lead cutter, which leads in the direction of driving and which is movable relative to the cutter.

Such a shaving apparatus is for example known from Netherlands Patent Application 7404 657 (PHN 7351). The lead cutters serve to slightly pull the hairs, so that a better shaving result can be obtained. The distance over which the hairs can be pulled is limited by the shape and dimensions of the cutter and the lead cutter and by the properties of the hairs and the skin.

It is the object of the invention to eliminate this restriction and this leads to a construction which is characterized in that each cutter, in addition to the said first lead cutter, is equipped with a second lead cutter which leads relative to the first lead cutter and which second lead cutter is movable relative to the first lead cutter.

A special embodiment is characterized in that each cutter is provided with more than two lead cutters, each second and further lead cutter being movable relative to an adjacent preceding lead cutter.

The invention is also embodied by a cutting unit as used in one of the embodiments described in the foregoing.

The invention will now be explained by means of a description of an embodiment shown in the Figures.

Figure 1 is an elevation of a shaving apparatus having three shear plates,

Figure 2 shows the shaving apparatus of Fig. 1 in side view and partly in a cross sectional view taken on the line II-II in Fig. 1,

Figure 3 shows the cutting member with lead cutters in perspective,

Figures 4, 5 and 6 illustrate the operation of the lead cutters,

The shaving apparatus in accordance with Figures 1 and 2 comprises a housing 1, of which a part takes the form of a shear plate holder 2 for three shear plates 3. The shear plates 3 are formed with hair-entry apertures 4.

As is shown in the partial cross-section of Fig. 2 a cutting unit 5 is situated on the inner side of a shear plate 3. This cutting unit 5, which for the sake of clarity is only shown schematically in Fig. 2, comprises a cutting member with cutters and lead cutters, and is shown in perspective view and on an enlarged scale in Fig. 3.

The cutting unit 5 is coupled to the electric motor 10, by means of the hollow spindle 6 (Fig. 2), the gear wheels 7 and 8 and the spindle 9, so that the cutting unit is rotatable relative to the associated shear plate 3. The gear wheel 7 is rotatably journaled on a pin 11, which is mounted in a mounting plate 12. The gear wheel 7 is formed with a recess 13, which is closed by a cover plate 14. This recess accommodates the flange 15 at the end of the hollow spindle 6. By giving the flange 15 a non-round, for example, square,

shape and by correspondingly shaping the recess 13, a coupling is obtained for transmitting the rotary movement of the gear wheel 7 to the spindle 6. The spring 16, which for the greater part is disposed in the hollow spindle 6 and which is tensioned between the hollow spindle 6 and the gear wheel 7, exerts a force on the spindle 6 in the direction of the cutting unit 5. As the cylindrical portion 17 of the spindle 6 bears against the cutting unit 5, said force is exerted on the cutting unit and via the cutting unit on the shear plate 3, so that the shear plate is urged against the shear plate holder 2 with the rim 18. The shear plate 3 together with the cutting unit 5 and the spindle 6 can be pressed inwards against the action of the spring 16 as a result of external forces, as may for example occur during use of the shaving apparatus..

The coupling for transmitting the rotary movement between the spindle 6 and the cutting unit 5 is obtained in that the spindle 6 is provided with an end 19 of substantially rectangular cross-section. This end 19 is situated in a corresponding coupling aperture 20 of the cutting unit 5.

The coupling with the electric motor 10 described in the foregoing is identical for the three cutting units of the apparatus in accordance with Figures 1 and 2, the three gear wheels 7 engaging with a single centrally disposed gear wheel 8 on the motor spindle 9.

The cutting unit 5 (Figure 3) comprises a cutting member 21 which is essentially constituted by a central member 22 which at its circumference is provided with cutters 23. The central body 22 has a coupling aperture 20. Each cutter 23 is provided with a first lead cutter 24 and a second lead cutter 25. The lead cutters 24 are combined to a lead cutter unit 26 which comprises a central portion 27 to which the lead cutters 24 are connected by means of the arms 28. In a

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similar way the lead cutters 25 form part of a lead cutter unit 29 with a central portion 30 and arms 31. Owing to the elastic properties of the arms 28 and 31 the lead cutters 24 and 25 are movable relative to the associated cutters 23.

In the assembled condition of the cutting unit the central body 22 of the cutting member 21 and the central portions 27 and 30 of the lead cutter units are connected to each other, for example by spotwelding.

Figures 4, 5 and 6 schematically represent a side view of a part of the cutting unit 5 and a part of the shear plate 3 and serve to illustrate the operation of the lead cutters. When a hair 32 is caught in a hair entry aperture 4 the rotary movement of the cutting unit 5 will soon bring the hair into contact with the sharp edge 33 of the lead cutter 25 at the location A. The sharp edge is such that it will slightly penetrate the hair 32 without cutting the hair. The reaction force which is exerted on the lead cutter 25 by the hair 32 will be opposed to the direction of movement P. This force is to be compensated for by the component N_1 of the normal force N which is exerted on the lead cutter 25 by the guide wall 34 of the lead cutter 24 (Fig. 4). For the sake of simplicity the slight frictional forces between the lead cutters 24 and 25 have been neglected. The component N_2 of the normal force N will cause the lead cutter 25 to slide along the guide wall 34. The angle α between the guide wall 34 and the wall 35 of the lead cutter 24 which engages with the shear plate 3 should be smaller than 90° .

As a result of inter alia the natural elasticity of the skin, the hair 32 will be taken along by the lead cutter 25 until the sharp edge 36 of the lead cutter 24 has reached the hair 32 at the location B (Fig. 5). Under the influence of a similar system of forces as illustrated in Fig. 4 the lead cutter 24 will slide along the guide wall 37 of the cutter 23. The hair

is now taken along by the lead cutter 24 until the cutting edge 38 of the cutter 23 has reached the hair at the location C (Fig. 6). Subsequently, the hair 32 will be cut off by cooperation of the shear plate 3 and the cutter 23. The length AB over which a hair can be pulled by a lead cutter is inter alia limited by the dimensions of the lead cutter, in particular the thickness D (Fig. 4). In theory the distance AC over which a hair can be pulled can also be achieved with a single lead cutter having a thickness 2D. The bending moment relative to the shear plate which is exerted on the hair 32 by the lead cutter then has a maximum arm AC and is therefore theoretically twice the bending moment exerted on the hair 32 in the case of two lead cutters 24 and 25 in accordance with Figures 4 to 6, the maximum arm being only AB or BC. This bending moment as a result of which the hair tends to be pressed against the inner side of the shear plate 3 is one of the main limiting factors in respect of the length over which the hair can be moved. By the use of two or more lead cutters this length may therefore be increased proportionally.

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CLAIMS:

1. A shaving apparatus comprising a drivable cutting unit with cutters, each cutter being equipped with a lead cutter, which leads in the direction of driving and which is movable relative to the cutter, characterized in that each cutter, in addition to the
5 said first lead cutter, is equipped with a second lead cutter which leads relative to the first lead cutter and which second lead cutter is movable relative to the first lead cutter.
- 10 2. A shaving apparatus as claimed in Claim 1, characterized in that each cutter is provided with more than two lead cutters, each second and further lead cutter being movable relative to the adjacent preceding lead cutter.
- 15 3. A cutting unit as used in a shaving apparatus as claimed in any of the preceding Claims.

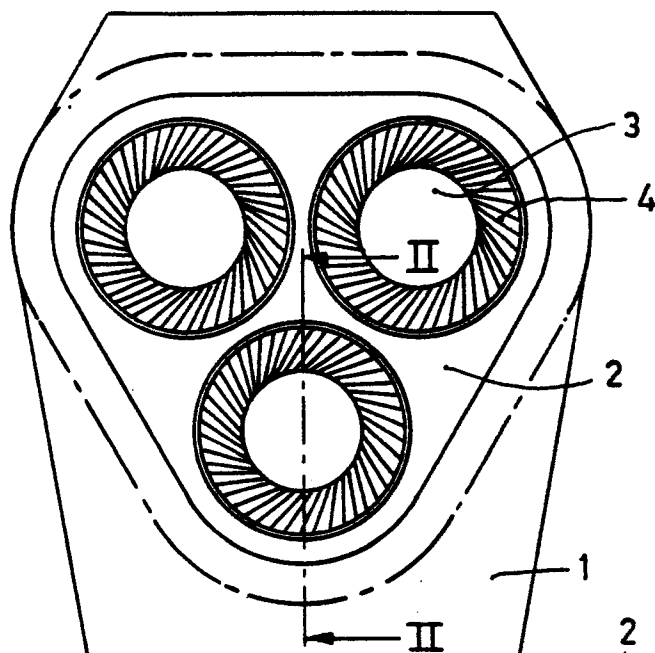


FIG. 1

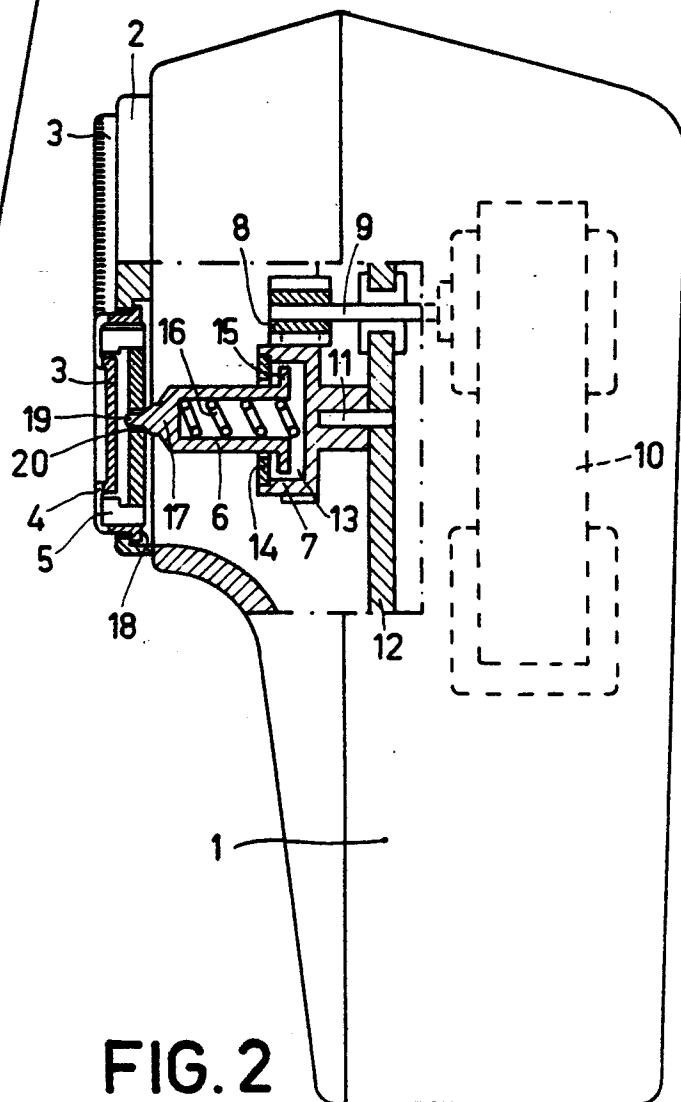


FIG. 2

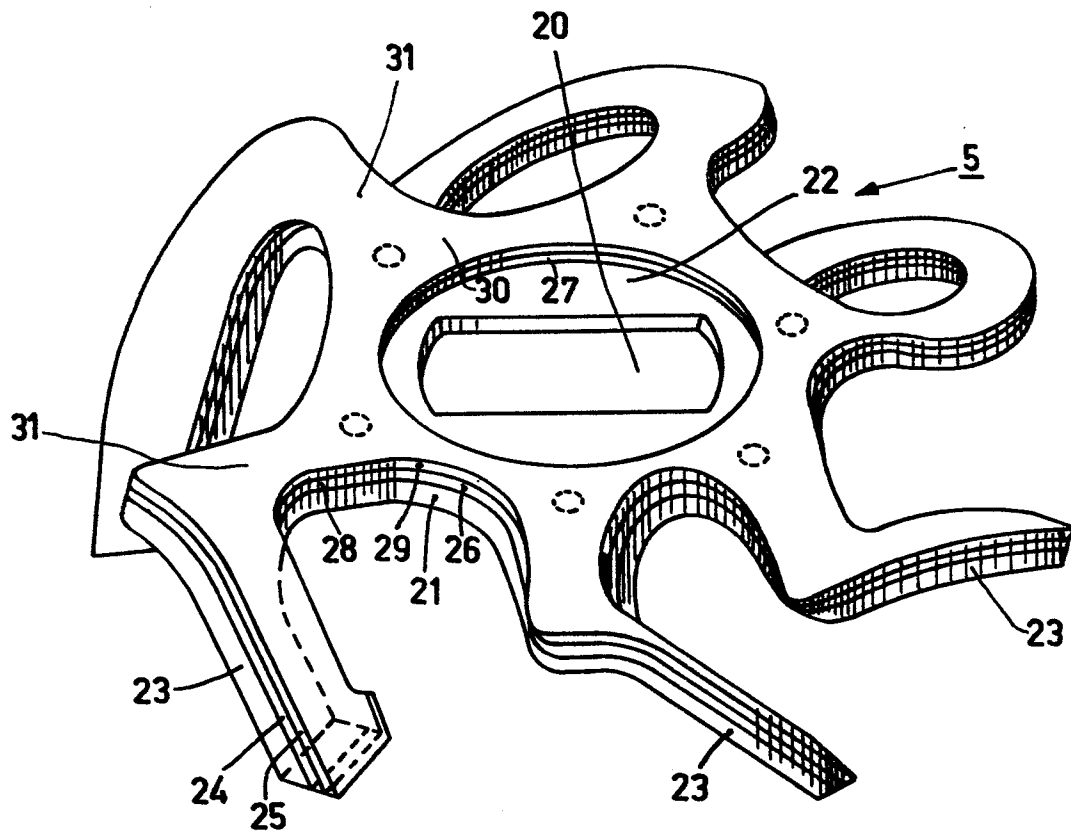


FIG. 3

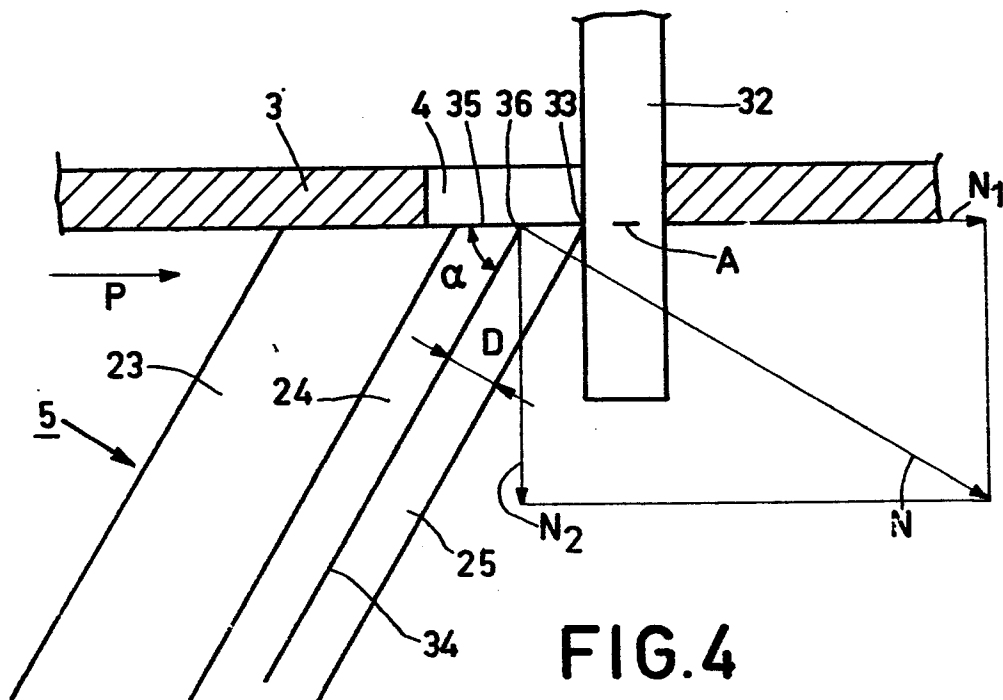


FIG. 4

