

[54] RAZOR WITH A RELATIVELY MOVING
BLADE AND ANVIL ASSEMBLY

[75] Inventors: **Bernard Stephen Hansom**, Church
Brampton; **Keith Douglas Ridler**,
Fulbourn, both of England

[73] Assignee: **The Mettoy Company Limited**,
Northamptonshire, England

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30/45, 210

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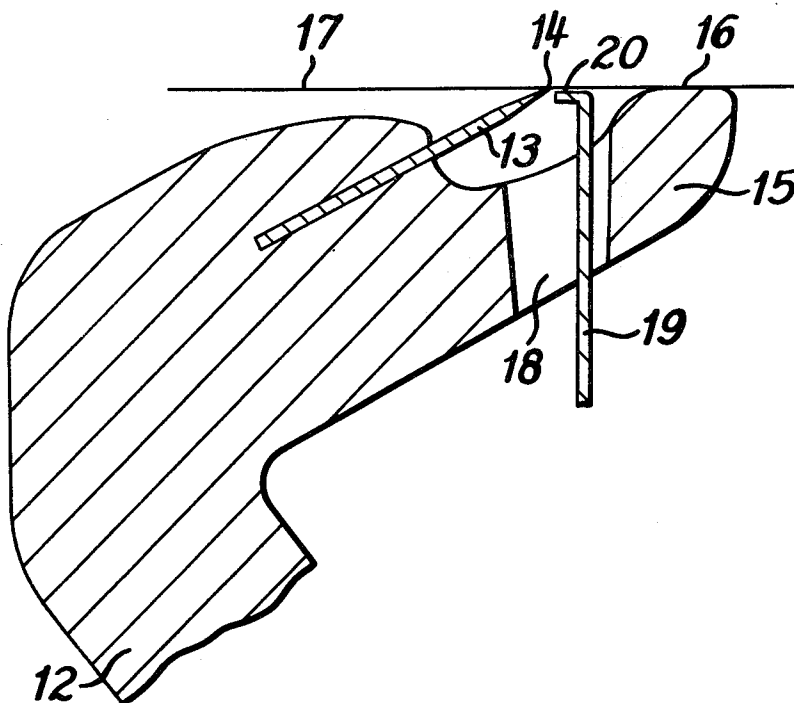
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Primary Examiner—Donald G. Kelly
Assistant Examiner—Gary L. Smith
Attorney, Agent, or Firm—Bacon & Thomas

[57] ABSTRACT

In a razor for dry shaving a cutting blade, of similar size to a conventional wet razor blade, is presented directly to the face to be shaved at a preferred shaving angle. An anvil (which may be a second cutting blade) provides a continuous edge, and relative movement between the cutting blade and the anvil effects cutting as a result of impact between the cutting edge of the cutting blade and hairs on the face while the hairs are supported by the continuous edge of the anvil. The relative movement between the cutting blade and the anvil must be such that no contact occurs between the cutting edge of the cutting blade and any part of the anvil.

9 Claims, 5 Drawing Figures



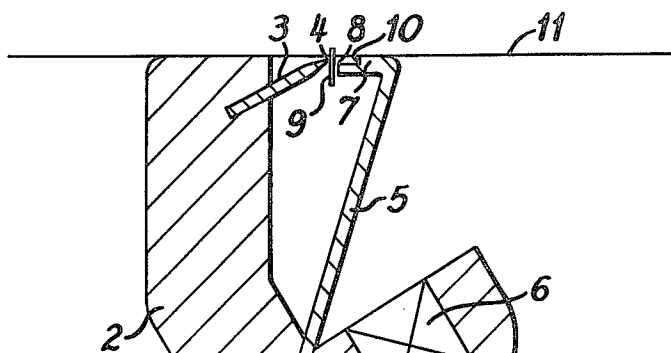


FIG. 1

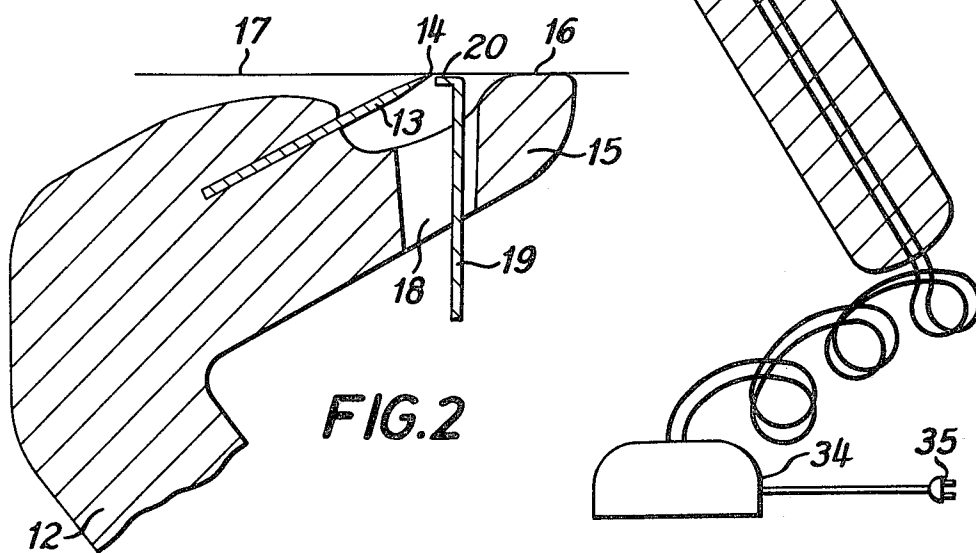
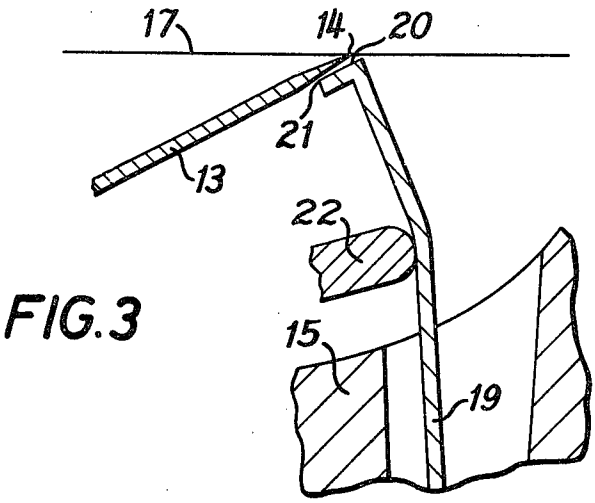
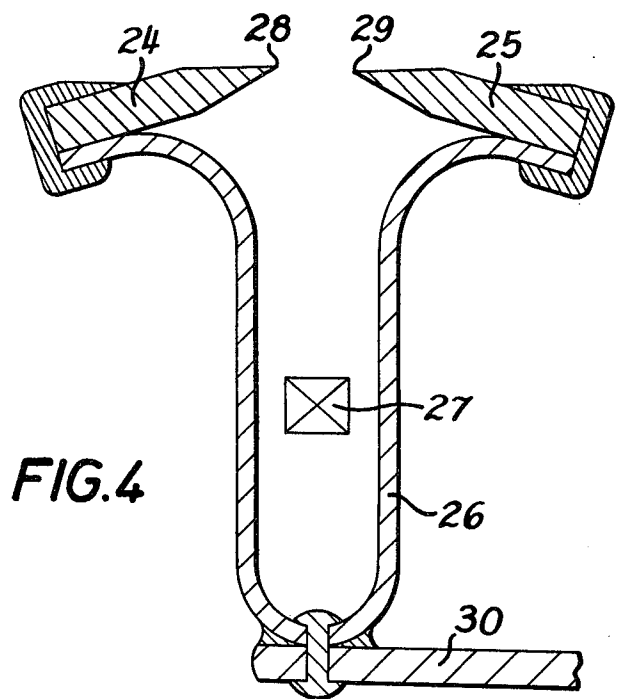
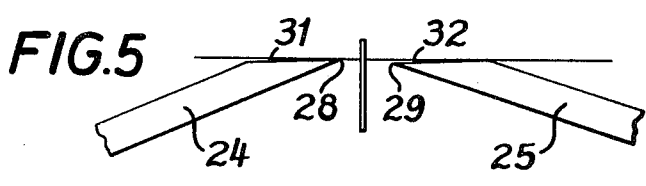


FIG. 2



RAZOR WITH A RELATIVELY MOVING BLADE AND ANVIL ASSEMBLY

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved razor for dry shaving.

According to the present invention there is provided a razor comprising a cutting blade having a cutting edge, an anvil having a continuous edge, and means for effecting relative movement between the cutting blade and the anvil, wherein, during shaving, the cutting edge is directly exposed to a face to be shaved and wherein the relative movement is such that the cutting blade and the anvil are brought into sufficient proximity to effect cutting of hairs in a plane which is normal to the face and which contains one of the edges, without any contact between the cutting edge and the anvil taking place.

It is an essential feature of a razor according to the present invention that, during operation of the razor in shaving, hairs shall be supported by the anvil at the instant of cutting the hairs using the cutting edge of the blade whilst avoiding any contact between the cutting edge and the anvil, and the cutting blade and the anvil must be brought into sufficient proximity for this to be achieved. In all the preferred embodiments of the present invention which will be described, the relative movement is such that one of the edges moves through the plane containing the other edge to effect cutting of hairs, but cutting could be effected by moving one edge into or sufficiently near to the plane containing the other edge.

A razor according to the present invention provides a cutting blade which may be arranged to contact the skin on a face at a shaving angle within the range of 23° to 30° which is known to be the optimum range for a wet razor employing a safety razor blade, whilst avoiding blunting of the cutting edge of the blade as a result of contact between the cutting edge and any anvil or reaping member which supports the hairs while they are being cut by the blade. The blade is adapted to be positioned with its cutting edge in contact with the skin of a face or in close proximity thereto without the interposition of an additional member. Advantageously the cutting edge on the cutting blade is of dimensions similar to the dimensions of the cutting edge on the tip of a conventional wet razor blade.

According to the preferred embodiments of the present invention there is provided a razor comprising a cutting blade having a cutting edge, an anvil having a continuous edge, and means for effecting relative movement between the cutting blade and the anvil, wherein, during shaving, the cutting edge is directly exposed to a face to be shaved and the cutting blade and the anvil are arranged so that one of the edges passes through a plane which is normal to the face and which contains the other edge to effect cutting of hairs in the said plane without any contact taking place between the cutting edge and the anvil, and wherein, after the said one of the edges has passed through the said plane to effect cutting, the anvil is on the side of the cutting edge which is remote from the face.

The continuous edge of the anvil may be substantially parallel to the cutting blade, when direct and simultaneous cutting of all the hairs trapped between the cutting blade and the anvil will occur, or the continuous

edge of the anvil may be arranged to provide a shearing action.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood from the following detailed description of embodiments thereof which is made by way of example with reference to the accompanying diagrammatic drawings in which:

FIG. 1 shows an embodiment of a razor illustrating the principle of the present invention,

FIG. 2 shows a preferred embodiment of a razor in accordance with the present invention,

FIG. 3 shows a modification for improving the razor of FIG. 2,

FIG. 4 shows an alternative embodiment of a razor in accordance with the present invention in which both the cutting blade and the anvil are caused to vibrate and the anvil is constituted by a second cutting blade, and,

FIG. 5 is a detail of a preferred arrangement of the two cutting blades in the razor of FIG. 4.

In the drawings the same or similar parts are designated by like reference numerals.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 of the drawings, there is shown a convenient design of razor in accordance with the present invention, the razor design being similar to the design of a conventional single-edge safety razor for wet shaving. The razor includes a handle 1 having a shaving head 2 in which there is mounted a fixed cutting blade 3 having a cutting edge 4. The cutting edge 4 is of similar dimensions to the cutting edge of a conventional safety razor blade.

Also mounted in the shaving head 2 is a vibrating reed 5 which is tuned to resonate at a desired frequency as a result of excitation by electric means 6 which may be either a vibrator or an exciter. The electric means 6 preferably comprises a drive coil which is wound to match a 500 c/s A.C. drive unit 34. Wires 33 from the coil pass down the handle 1 and connect into the encapsulated drive unit 34. The drive unit may be adapted to connect into known types of shaver outlet in A.C. mains supply by means of a two pin plug 35. An end 7 of the reed 5 constitutes an anvil having a continuous edge 8 which is parallel to the cutting edge 4 of the cutting blade 3 but which, in its rest position, is spaced from the cutting edge 4 of the cutting blade 3 to permit hairs such as 9 on the face to extend between the cutting edge 4 of the cutting blade 3 and the continuous edge 8 of the anvil 7. The reed 5 and the anvil 7 are designed to have a natural resonant frequency of the order of 500 c/s in order to match with the 500 c/s drive unit. Maximum efficiency of the electric means 6 will then be obtained.

When the reed 5 is vibrated by the electric means 6, the continuous edge 8 is caused to move from the rest position shown in FIG. 1 to the left through the plane normal to the face and containing the hair 9 so that the continuous edge 8 of the anvil 7 overlaps the cutting blade 3. At the instant of passing through the plane normal to the face and containing the cutting edge 4, the continuous edge 8 of the anvil 7 is parallel to the cutting edge 4 but spaced from that cutting edge 4 by an amount of the order of two-thousandths of an inch. Impact damage of the cutting edge 4 on the anvil 7 is thereby avoided.

In the razor of FIG. 1 the anvil 7 extends nearer to the face than the continuous edge 8 but this portion of the anvil 7 is cut away to form a recess having an end face 10. The length of the recess is such that there is no contact between the cutting edge 4 and the end face 10 in the cut-away recess of the anvil 7. The length of the end face 10 is of the order of three-thousandths of an inch and there is a spacing of the order of one-thousandth of an inch between the cutting edge 4 of the cutting blade 3 and the face line 11 which is determined by the outer edge of the anvil 7 and the end surface of the shaving head 2.

The geometry of the razor of FIG. 1 is such that the cutting blade 3 is at an angle of 27° to the plane which passes through the cutting edge 4 and which is parallel to the face line 11.

In FIG. 2 there is shown diagrammatically a portion of the preferred embodiment of a razor in accordance with the present invention. The razor of FIG. 2 has a shaving head 12 which replaces the shaving head 2 of FIG. 1, the remaining parts of the razor being similar to the remaining parts of the razor of FIG. 1. In the shaving head 12 there is mounted a cutting blade 13 having a cutting edge 14 and the shaving head 12 also includes a guard member 15 which partially protects the cutting edge 14. An end 16 of the guard member 15, together with the cutting edge 14 of the cutting blade 13 defines the face line 17, to which the cutting blade 13 is mounted at an angle of the order of 27° which is the optimum shaving angle.

In the guard member 15 there is an aperture 18 through which there extends a vibrating reed 19. The vibrating reed 19 is mounted in the handle of the razor, which is similar to the handle 1 of FIG. 1, for vibration under the control of electric means which is similar to the electric means 6 of FIG. 1. The end 20 of the reed 19 is located between the cutting edge 14 and the guard member 15 at a distance of the order of one-thousandth of an inch from the face line 17, this end 20 of the reed constituting the anvil which is moved past the cutting edge 14 during reciprocation by vibration of the reed 19.

The razor in accordance with FIG. 2 has the advantage over the embodiment of the invention which is the razor of FIG. 1 in that the vibrating reed 19 does not come into direct contact with the face and is therefore not subjected to the same damping effect as is liable to occur with the reed 5 of FIG. 1.

In operation of the razors of both FIGS. 1 and 2, the vibrating members (i.e. the reed 5 and the reed 19) precede the cutting blade 3 or the cutting blade 13 in the direction of motion of the razor. As the anvil 7 or the anvil 20 at the end of the reed passes over the hair this is flattened against the face and when the anvil has passed right over the hair, the hair will spring up. As the hair grows, on average, to a length of the order of twenty-thousandths of an inch between shaves, the anvil will be twenty-thousandths of an inch away from the base of the hair at the time that the hair springs up, and the anvil will then return during the reciprocation to the hair base and provide support for the cut. The edge of the anvil must therefore move a distance of at least 0.020 inches (and preferably a distance of the order of 0.050 inches) away from the cutting edge of the cutting blade during the reciprocation. This distance is measured substantially along the face line.

However, it is perfectly possible for the cutting blade to be caused to vibrate instead of the anvil and the cutting blade would then be mounted on a vibrating reed. When the cutting blade vibrates and the anvil is stationary the cutting blade should precede the stationary anvil in the direction of motion of the razor during shaving.

While it is convenient if the frequency of reed vibration could be set for 50 or 60 cycles per second, this frequency of vibration requires a razor speed of the order of 1 inch per 10 seconds, which is very slow. It is therefore preferred for the frequency of reed vibration to be of the order of 500 cycles per second which means that the edge which is mounted on the vibrating reed is travelling at a speed of 50 inches per second when the edge is moving 0.025 inches either side of the mid-point of the vibration. Under these conditions, if the razor is moved over the face at a speed of the order of 1 inch per second, one complete cycle of vibration of 2 milliseconds corresponds to two-thousandths of an inch movement of the razor. The hair is about four-thousandths of an inch in diameter mounted in a flexible socket in a flexible area of skin. Thus, whenever a hair is caught up against a fixed part of the razor head it will only have to distort the skin or the hair a maximum of two-thousandths of an inch before the cutting cycle is complete.

The frequency of reed vibration is not critical if the user of the razor is prepared to move it over the face at the appropriate speed.

Any moving edge will have maximum kinetic energy at the mid-point of its reciprocating movement and therefore ideally the mid-point of the reciprocating movement should be approximately one hair's breadth (0.004 inches) short of the plane which is normal to the face and which includes the other edge. Maximum force will then be exerted between the hair and the cutting edge to effect cutting of the hair.

As already stated the geometry of the arrangement must be such that no contact takes place between any cutting edge and the other member (a second blade or the anvil). However, as any moving edge passes through the plane which is normal to the face and which includes the other edge, the two edges should be within less than a hair's breadth (0.004 inches) of one another so as to effect cutting of the hair. Preferably the two edges should be within 0.002 inches of one another when the edges are both in the same plane normal to the face.

The avoidance of contact between the cutting edge and the other member may be facilitated by the modification in the arrangement of the vibrating reed which is shown in FIG. 3, which is a substantially enlarged modification of part of the shaving head 12 of the razor of FIG. 2. The modification resides in the inclusion of a resilient stop 22 against which the reed 19 impinges after the continuous edge 21 at the end 20 of the reed 19 which constitutes the anvil has passed through the plane normal to the face and containing the cutting edge 14 of the cutting blade 13.

As shown in FIG. 3, the resilient stop 22 is positioned substantially below the end 20 of the reed 19 and the impact between the reed 19 and the resilient stop 22 causes the portion of the reed between the area of impact and the end 20 to curve over in a secondary motion which causes the continuous edge 21 to move in a

path less close to the cutting blade 13 than it would otherwise move.

Referring now to FIGS. 4 and 5, there is shown a razor in accordance with the present invention which is modified in that both the cutting blade and the anvil are caused to vibrate in the reciprocating motion and that the anvil is constituted by a second cutting blade.

In FIG. 4, the first and second cutting blades 24 and 25 are mounted on opposed arms of a tuning fork 26 which is arranged to be excited by an electric device 27 so that the tuning fork will vibrate at its resonant frequency. During the vibration the cutting edges 28 and 29 on the first and second cutting blades 24 and 25 are caused to overlap to effect cutting of hairs extending between them. In this embodiment of the invention the cutting edges 28 and 29 coincide in a plane normal to the face line at approximately the mid-point of the reciprocating motion.

One advantage of using a tuning fork to effect the reciprocating motion, as in the razor of FIGS. 4 and 5, is that the vibration is isolated from the handle which is shown diagrammatically in FIG. 4 at 30.

In order to facilitate the movement of one blade 25 past the other blade 24 without any contact between the two blades taking place, the cutting edges 28 and 29 on the two blades are preferably formed by grinding only the outside edges 31 and 32 of the cutting blades 24 and 25. This grinding of the outside edges 31 and 32 is illustrated in FIG. 5 of the accompanying drawings. In all the embodiments of the invention it is important that the two edges which are reciprocated relative to one another to effect the cutting action shall be edges parallel or skew to one another and spaced from one another to avoid contact during reciprocation.

In all the embodiments of the present invention which have been specifically described, there is provided an electric razor having a cutting blade the plane of which is presented to the face at an angle of up to 30° and which operates to effect cutting of the hairs on the face by relative movement between the cutting edge of the blade and another member constituting an anvil, the cutting edge of the cutting blade being directly exposed to the skin on the face during the said relative movement.

For most advantageous results, the geometry of a razor in accordance with the present invention should be such as to fulfil all the following requirements:

1. The reciprocating movement of the moving member (or members) should be such that the mid-point in the travel of any moving member is when the edge of that member is about one hair's breadth short of the plane which is normal to the face and which contains the edge of the other member. Maximum force is then exerted on the hair to effect cutting.

2. At one extreme of the reciprocating movement, the moving member (or members) will have moved so that the edge of any moving member has moved up to or beyond the plane which is normal to the face and which includes the edge of the other member.

3. At the other extreme of the reciprocating movement, the gap between the plane which is normal to the face and which contains one edge and the plane which is normal to the face and which contains the other edge must be at least 20 thousandths of an inch (the average length to which hair grows between shaves) and is preferably of the order of 50 thousandths of an inch, measured substantially along the face line.

4. At no stage during the movement of one or both members will the cutting edge of the cutting blade touch the other member.

We claim:

1. A razor comprising a shaving head which includes a fixed guard member having an end surface, means, including the end surface of the guard member, defining a first plane, a cutting blade mounted in the shaving head at a desired shaving angle, an exposed cutting edge on the cutting blade which exposed cutting edge is spaced from the end surface of the fixed guard member and which exposed cutting edge lies in the proximity of the said first plane, an anvil mounted in the shaving head adjacent the cutting edge, a continuous edge on the anvil, and means for effecting relative movement between the cutting blade and the anvil by causing at least one of the cutting edge and the continuous edge to be reciprocated in such manner that the said one edge passes through a second plane which contains the other edge and which is normal to the said first plane, the said continuous edge and the said cutting edge are in close proximity the one with the other at the instant of the said one edge passing through the second plane, and contact between the cutting edge and the anvil is avoided, whilst the cutting edge remains exposed throughout the reciprocation.

2. A razor according to claim 1 wherein the continuous edge of the anvil is substantially parallel to the cutting edge of the cutting blade.

3. A razor according to claim 1 wherein the cutting blade is rigidly mounted in the razor and the means for effecting relative movement effects movement of the anvil.

4. A razor comprising a shaving head which includes a fixed guard member having an end surface, a cutting blade fixedly mounted in the shaving head at a desired shaving angle and spaced from the guard member, an exposed cutting edge on the cutting blade, the exposed cutting edge being spaced from the end surface of the fixed guard member and the exposed cutting edge together with the end surface of the guard member defining a first plane, an anvil, a continuous edge on the anvil, moveable means mounting the anvil in the shaving head for movement relative to the cutting blade within the space between the guard member and the cutting blade, and means for moving the anvil such that the continuous edge is reciprocated to and fro through a second plane which contains the cutting edge and which is normal to the said first plane, the said continuous edge passes in close proximity to the said cutting edge at the instant that the said continuous edge passes through the second plane, and contact between the cutting edge and the anvil is avoided, whilst the cutting edge on the cutting blade remains exposed throughout the reciprocation.

5. A razor according to claim 4 wherein the anvil having the continuous edge is mounted on a reed which is arranged for reciprocation by an electric exciter or vibrator.

6. A razor comprising a shaving head which includes a tuning fork having opposed arms, a cutting blade mounted on one of the opposed arms of the tuning fork at a desired shaving angle, an exposed cutting edge on the cutting blade, an anvil mounted on the other of the opposed arms of the tuning fork, a continuous edge on the anvil which is parallel to the cutting edge of the cutting blade, and an electric vibrator arranged to excite

the tuning fork at a resonant frequency to cause movement of both the cutting edge and the continuous edge such that, at one stage of the excitation of the tuning fork, the cutting edge and the continuous edge are spaced apart and, at another stage in the excitation of the tuning fork, the cutting edge and the continuous edge pass in close proximity one with the other and the cutting blade and the anvil overlap, and contact between the cutting edge of the cutting blade and the anvil is avoided, whilst the cutting edge on the cutting blade remains exposed throughout the excitation of the tuning fork.

7. A razor according to claim 6 wherein the continuous edge of the anvil is constituted by the cutting edge of a second cutting blade.

8. A razor according to claim 7 wherein the cutting edges on the first and second blades are ground on substantially one side only, the ground sides being presented to the face during shaving.

9. A razor comprising a shaving head which includes a fixed guard member having an end surface, a cutting blade fixedly mounted in the shaving head at a desired shaving angle and spaced from the guard member, an exposed cutting edge on the cutting blade, the exposed cutting edge being spaced from the end surface of the fixed guard member and the exposed cutting edge together with the end surface of the guard member defin-

ing a first plane, an anvil, a continuous edge on the anvil, a reed upon which the anvil is mounted in the shaving head with the continuous edge substantially perpendicular to the length of the reed and substantially parallel to the cutting edge of the cutting blade, means for causing the reed to reciprocate at a resonant frequency for movement of the anvil relative to the cutting blade within the space between the guard member and the cutting blade, such that the continuous edge is reciprocated to and fro through a second plane which contains the cutting edge and which is normal to the said first plane, the said continuous edge passes in close proximity to the cutting edge at the instant that the said continuous edge passes through the second plane, and contact between the cutting edge and the anvil is avoided, whilst the cutting edge on the cutting blade remains exposed throughout the reciprocation, and a resilient stop in the shaving head for abutting the reed during reciprocation of the reed after the continuous edge has passed through the second plane, the impact of the reed against the resilient stop causing a secondary motion of the continuous edge of the anvil away from the cutting blade, thereby ensuring the avoidance of contact between the continuous edge and the cutting blade.

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