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[72] Inventors **Frans Zuurveen**
Emmasingel, Eindhoven;
Eduard Willem Tietjens, Oliemolenstraat,
Drachten, both of Netherlands

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[73] Assignee **U.S. Philips Corporation**
New York, N.Y.
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[54] **RESILIENTLY SUPPORTED SHEAR PLATE**
8 Claims, 2 Drawing Figs.

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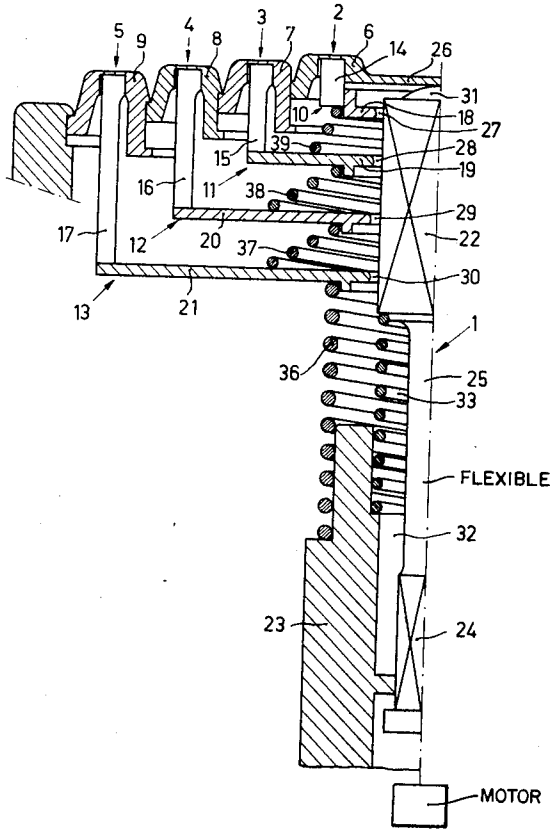
Primary Examiner—Robert C. Riordon
Attorney—Frank R. Trifari

ABSTRACT: A dry-shaving apparatus having a single driving shaft and at least one shaving head which is actuated by the driving shaft and is adapted to be axially depressed and comprises a shear plate and a cooperating movable cutter member which is maintained in resilient engagement with the shear plate, the central shear plate being also supported by a separate, axially adjustable spring.



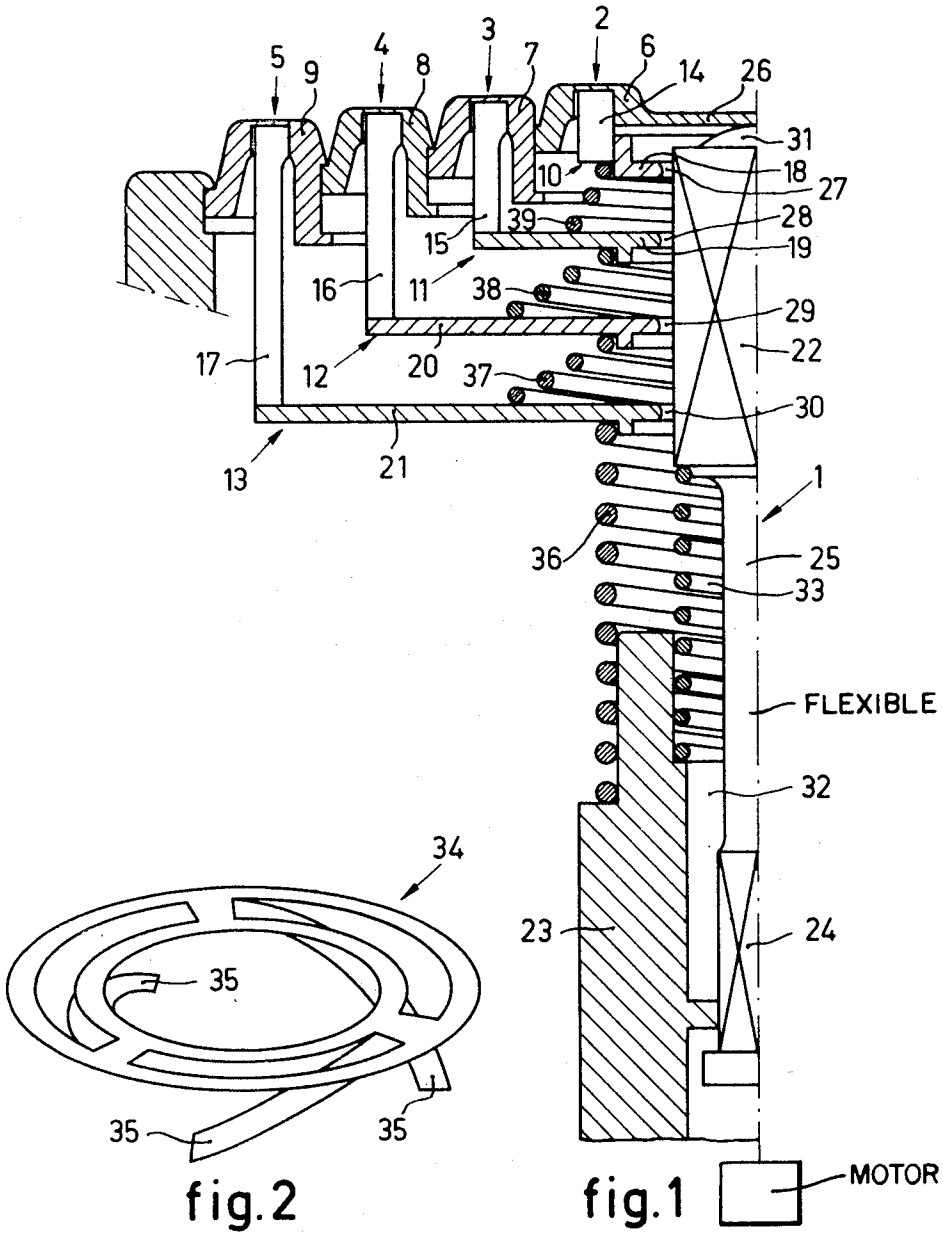


fig.2

fig.1

INVENTORS
FRANS ZUURVEEN
EDUARD W. TIETJENS
BY
Frank R. Trifari
AGENT

RESILIENTLY SUPPORTED SHEAR PLATE

The invention relates to a dry-shaving apparatus having at least one group of shaving heads and a single driving shaft; at least one shaving head is actuated by the driving shaft, is adapted to be depressed and includes a shear plate and a cooperating movable cutter member which is maintained in resilient engagement with the shear plate.

In constructing a satisfactorily operating dry-shaving apparatus, one of the central problems is to achieve a maximum effective shaving area.

In the known dry shavers, an attempt to solve this problem includes imparting to the shaving head a certain adaptability to the various shapes of the face, which adaptation is made possible by the various positions which the depressible shaving head can occupy relative to the face. One of the factors which determine the resistance offered by the skin in this adapting process is the force with which the cutting member is urged against the shear plate. In the known shaving apparatus, this resistance force produces a skin pressure which, as experience has shown, is not always sufficient to produce a close shave, with the result during use of the known apparatus, that the shear plates are usually pressed into their extreme depressed positions thus instead of adaptation of the shear plate to the various shapes of the face, the only adaptivity factor remaining is the capacity for deformation of the shear plate itself.

It is an object of the present invention to eliminate or at least obviate the above-mentioned drawback. Also the invention is distinguished by the fact that the shear plate is supported by a separate spring which enables the skin pressure to be increased.

In one embodiment of the invention, there is, for the resilient support of the shear plate, a resiliently arranged driving shaft which actuates the cutter member, for which purpose the end of the driving shaft facing the shear plate is in line or point contact with the surface of the shear plate facing the driving shaft.

Obviously the invention is not restricted to this embodiment relating to a resilient support of the shear plate with a thrust force confined within a narrow limit. In other constructions, for example the spring pressure is adjustable.

According to the above-mentioned embodiment the driving shaft is coupled with the cutter member for driving same in rotation, the upper part of the driving shaft being shaped in the form of a coupling pin which passes with a certain amount of clearance through an aperture disposed centrally of a blade-carrying holder part of the cutter member, while the free end of the coupling pin is maintained in engagement with the shear plate.

A highly advantageous embodiment in which at least two shaving heads are used which are engaged by their mutually adjacent side edges is distinguished in that between the driving shaft and a motor coupling shaft there is established a coupling which is movable in at least two directions; the lower part of the driving shaft has a noncircular cross section and is coupled with the motor coupling shaft, and is arranged so as to be movable in a centrally disposed aperture in this motor coupling shaft. This aperture extends from the free end of the motor coupling shaft in the direction of length thereof, while the part of the driving shaft situated between this lower part and the coupling pin is flexible or bendable relative to its own longitudinal axis.

The said movability of the driving shaft and the increase in the minimum number of shaving heads, which in addition are situated so as to be capable of a relative vertical sliding movement, increase the adaptability of the shaving plates to the various shapes of the face.

The invention will be described more fully with reverence to a drawing, which shows an embodiment and from which further advantageous features will become apparent:

FIG. 1 is a longitudinal sectional view of an embodiment according to the invention; and

FIG. 2 is a perspective view of a spring system which may be used in the resilient support of the driving shaft.

Referring to FIG. 1, there is shown a group of shaving heads, which are operated by a single driving shaft 1.

In the embodiment shown there are four shaving heads 2, 3, 4 and 5, having shear plates 6, 7, 8 and 9 respectively, arranged concentrically about drive shaft 1 these plates are engaged to each other by their mutually adjacent side edges which extend traversely to the axis of the drive shaft. In this sectional view of FIG. 1, each shear plate has a generally inverted U-shape and the inner sidewall of plate 6 merge into a substantially flat plate 26. The shear plates 6, 7, 8 and 9 cooperate with cutter members 10, 11, 12 and 13 respectively, Each cutter member comprises at least one blade arm 14, 15, 16 and 17 and a blade-carrying holder part 18, 19, 20 or 21, respectively.

The driving shaft 1 comprises an upper part shaped in the form of a coupling pin 22, a lower part 24 cooperating with a motor coupling shaft 23 and an intermediate middle part 25.

The coupling pin 22, has a cross-sectional area which is greater than that of the middle part 25 of the driving shaft 1, and which passes with a certain amount of clearance through apertures 27, 28, 29 and 30 provided centrally of the blade-carrying holder parts 18, 19, 20 and 21 respectively. The coupling pin 22 is engaged to these holder parts for driving same in rotation about the drive shaft axis.

The end 31 of the coupling pin 22 facing the shear plate 6 has a curved surface which is maintained in engagement with that surface 26 of the plate which faces the driving shaft 1. The lower part 24 of the driving shaft is axially movable in a central aperture 32 in the motor coupling shaft 23, which aperture 32 extends from the free end of shaft 23 axially towards the motor (not shown) of the apparatus.

The middle part 25 of the driving shaft 1 is surrounded by a spring 33; the free end of the motor coupling shaft 23 and that end of the coupling pin 22 which faces the motor coupling shaft 23 form the abutments which the ends of the spring 33 resiliently engage. The spring 33 may be a helical spring, as is shown in FIG. 1, but it may also take the form of a spring system 34 (FIG. 2) comprising at leas three parallel connected leaf springs 35. While the driving shaft 1 actuates at least two shaving heads, the middle part 25 of this shaft 1 is flexible or bendable about its own axis.

Obviously the invention is not restricted to embodiments in which the separate spring which supports the central shear plate is situated so as to surround the driving shaft. Alternative constructions in which a driving shaft is resiliently supported, result in an additional resilient support of the central shear plate. Furthermore, separate springs of selectable spring pressure can be used in the invention to particular advantage, because they enable the invention to be successfully applied to the shaving of highly sensitive parts of the face. The blade-carrying holder parts of the cutter members are resiliently supported by a spring system comprising separate springs 36, 37, 38 and 39 connected in series.

We claim:

1. In a dry shaver including a housing, a rotary drive shaft, and a shaving head actuated by said shaft and comprising an axially depressible shear plate, first means resiliently urging the shear plate outward relative to the housing and a cooperating cutter engaged and driven by the shaft, the shaver further comprising second means resiliently urging the shaft outward, the shaft having a first end engaging a portion of said shear plate and urging same outward.

2. In a dry shaver including a housing, a rotary drive shaft, and a shaving head actuated by said shaft and comprising a plurality of concentric, axially and independently depressible shear plates including a central plate, a rotatable cutter operable with each shear plate, each cutter having a central aperture through which extends said drive shaft in driving engagement, first resilient means urging each cutter outward against its corresponding shear plate, separate second resilient means urging the drive shaft outward, the shaft having a first end in engagement with the central shear plate and urging same outward, the shear plates each engaged to the adjacent plate for

limited relative movement, whereby said plates are axially depressible against said resilient means associated therewith.

3. Apparatus according to claim 1 wherein said first end of the shaft and the shear plate have adjacent surfaces that are engaged, this engagement comprising at least point contact formed by at least one point of one of said surfaces in contact with the other surface.

4. Apparatus according to claim 3 wherein one of said engaging surfaces of the shaft and shear plate is substantially planar and the other is curved.

5. Apparatus according to claim 1 and further comprising an electric motor wherein said shaft has a second end remote from the first end which is rotatably driven by said motor, the cutter is rotatably driven by the first end of the shaft, and both ends of the shaft are axially movable relative to the cutter and motor.

6. Apparatus according to claim 5 wherein said drive shaft has a third part intermediate said first and second ends which is bendable relative to its own axis.

7. Apparatus according to claim 2 wherein said shaft has a central part axially spaced from said first end, that is bendable relative to its own axis.

8. Apparatus according to claim 2 wherein each resilient means comprises at least one spring having a selected spring pressure applicable to the components of the apparatus it contacts.

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