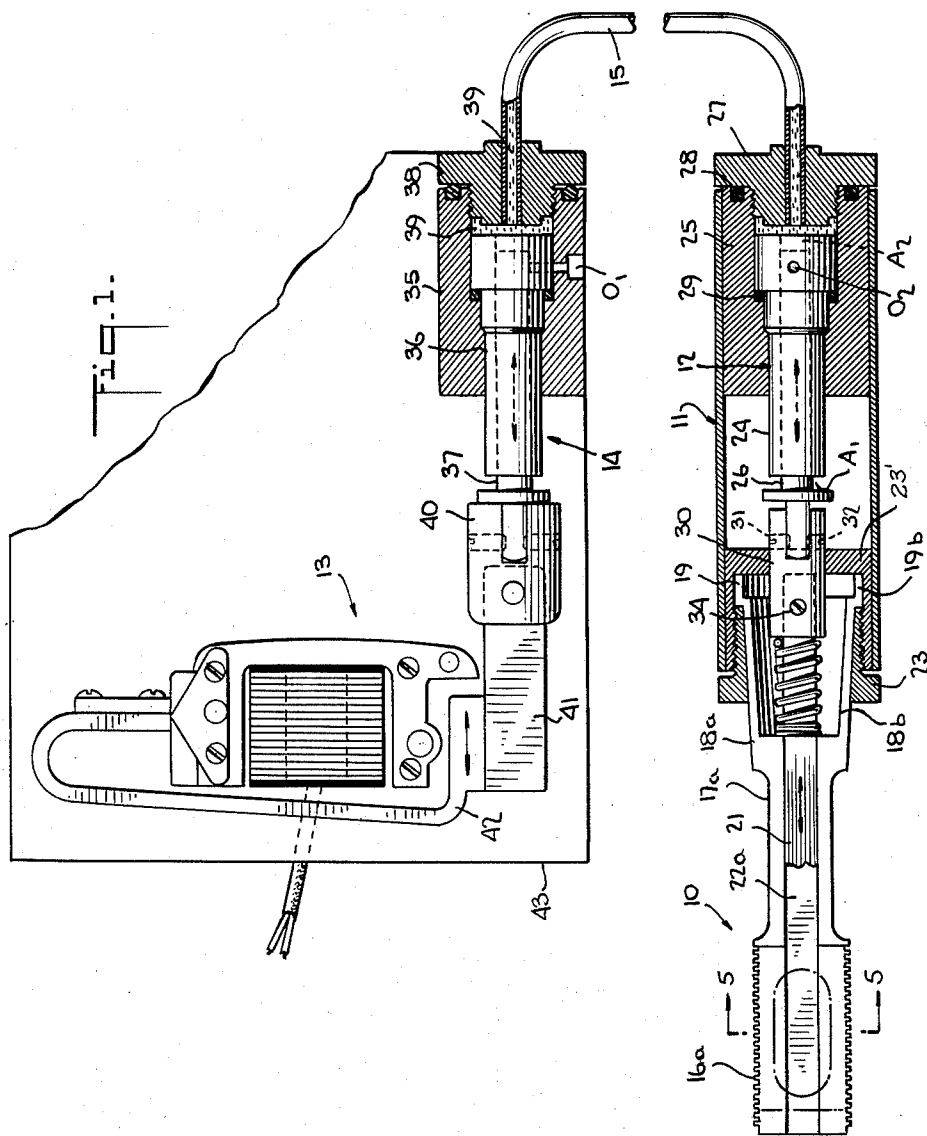


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HYDRAULIC SHAVING IMPLEMENT

2 Sheets-Sheet 1



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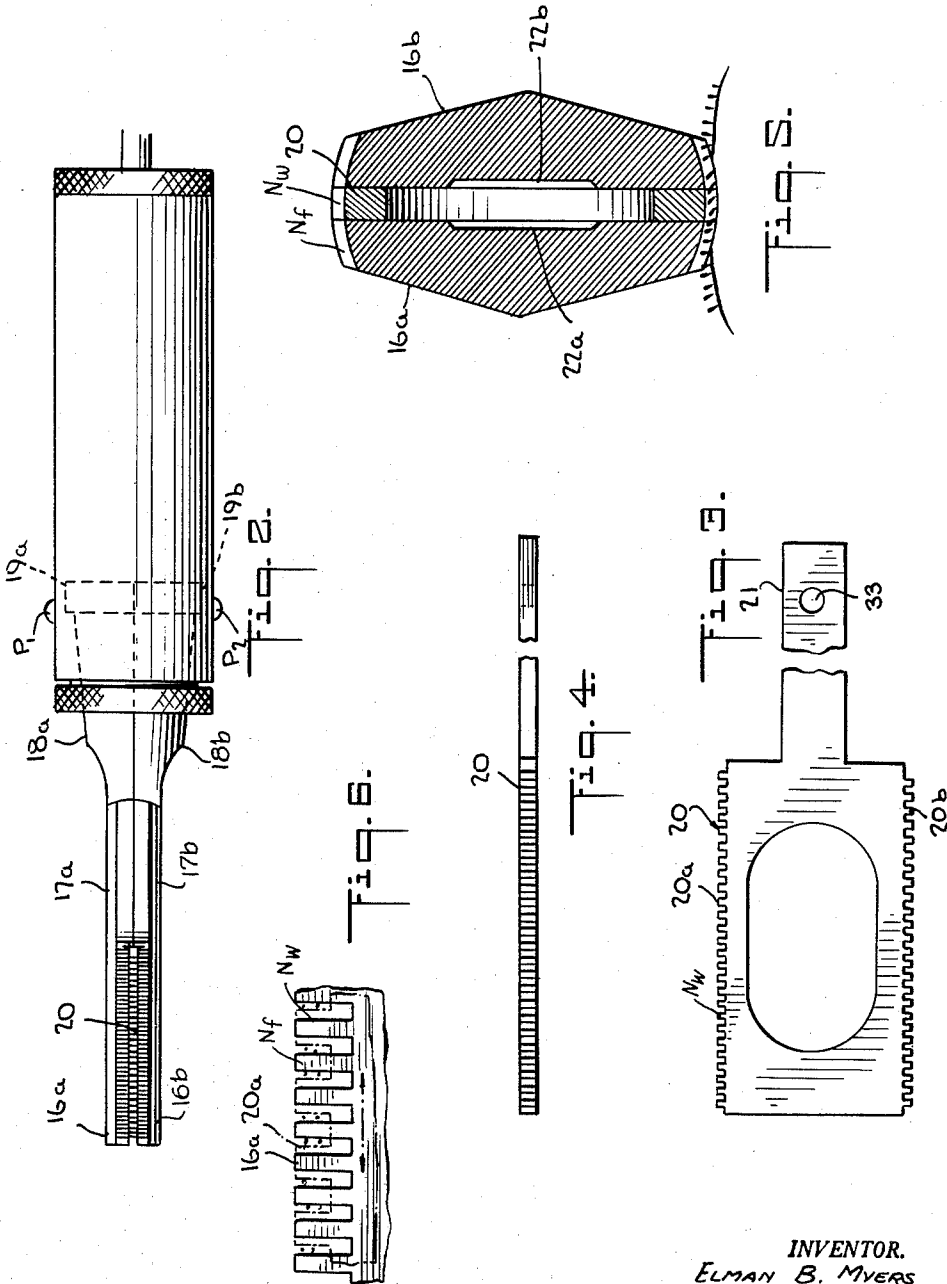
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3,093,900

HYDRAULIC SHAVING IMPLEMENT

Filed Sept. 14, 1959

2 Sheets-Sheet 2



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HYDRAULIC SHAVING IMPLEMENT

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Filed Sept. 14, 1959, Ser. No. 839,707

2 Claims. (Cl. 30-45)

The present invention pertains generally to shaving and hair-cutting implements and more particularly to a hydraulically-driven razor of high efficiency.

Various types of electric shavers are currently available on the market. Essentially such shavers are constituted by an electrically-driven blade which reciprocates or rotates with reference to a perforated or grooved guard. In operation, the guard is pressed against the skin of the user so that hairs entering the pores or openings therein are sheared off by the blade. Among the drawbacks of conventional electric razors are heat, noise and vibration as well as an unsatisfactory cutting action giving rise to skin irritation. Experience has shown that the cutting edges of commercial electric razors become dull after repeated use and as a consequence, coarse hairs are broken off, and fine hairs are plucked out rather than sheared, thereby irritating the skin.

Lack of power in the rotating and reciprocating units of electric razors and lack of iron in the magnetic vibrator types produce heating effects which cause serious discomfort to the user. Heating is further enhanced by the necessary physical pressure against the skin during shaving.

All existing types of electric razors make use of a guard which separates the moving cutter from the face. In some instances, the guard is designed to roll the hair into the cutting zone and in other types radial V slots are provided as a hair entrance. But regardless of the type of guard used, it acts as a mechanical spacer between the surface of the skin and the cutting zone, and thereby determines the length of hair stubble which remains after cutting.

In conventional electric shavers, the motor is ordinarily housed in the handle of a shaver and as a result, the form of a shaver is generally clumsy and poorly accommodated to normal hand operation.

In view of the foregoing, it is the primary object of the present invention to provide an improved shaving mechanism, which mechanism operates safely in direct contact with the face to effect a shearing action without irritation or damage to the epidermis.

More particularly, it is an object of the invention to provide a hydraulically-driven shaving implement which is noiseless and substantially free of friction during operation, which instrument may be readily sterilized without damage to the parts.

A significant feature of the shaving instrument in accordance with the invention is that it is anatomically accommodated to ensure direct contact with all contours of the surface to be shaved through the simple expediency of normal wrist motion and hand engagement. Finger pivots are provided for this purpose to facilitate the proper orientation of the instrument.

It is also an object of the invention to provide a shaving implement including a shaving head assembly and a handle, the weight distribution of the instrument being equipoised in the hand.

Also an object of the invention is to provide an in-

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strument having a renewable blade, the blade being hydraulically reciprocated relative to stator elements, the instrument being light in weight, cool and quiet in operation and exceptionally efficient in its shaving action.

For a better understanding of the invention as well as other objects and further features thereof, reference is had to the following detailed description to be read in conjunction with the accompanying drawing wherein like components in the several views are identified by like reference numerals.

In the drawings:

FIG. 1 illustrates a hydraulically-driven shaving implement in accordance with the invention operating in conjunction with an electrically-energized hydraulic actuator, the shaving implement and its actuator being shown in longitudinal section.

FIG. 2 is an elevational view of the shaving implement, the shaving head assembly therein being turned at right angles to its position in FIG. 1.

FIG. 3 is a plan view of the movable blade in the head assembly.

FIG. 4 is a side view of the movable blade.

FIG. 5 is a transverse section taken in the plane indicated by lines 5-5 of FIG. 1.

FIG. 6 is a fragmentary view showing the meshing relationship between the teeth of the movable blade and one of the stator segments forming the head assembly.

Referring now to the drawings and more particularly to FIGS. 1 and 2, the major components of the shaving implement are a shaving head assembly 10, a handle 11 for supporting said assembly and a first hydraulic reciprocator 12 housed within the handle to drive the movable blade in the head assembly. The hydraulic actuator for the implement is constituted by an electrically energized vibrator 13 which operates a second hydraulic reciprocator 14, identical to reciprocator 12, the two reciprocators being intercoupled by a flexible tube 15.

The shaving head assembly 10 is constituted by two complementary metallic elements which are shaped to define a pair of matching stator segments 16a and 16b extending from shank segments 17a and 17b, the shank segments projecting from conical base segments 18a and 18b which terminate in annular flange segments 19a and 19b.

Slidably interposed between stator segments 16a and 16b is a movable blade 20 having a rectangular shape, the blade being provided with a longitudinally extending stem which is slidable within complementary channels 22a and 22b formed within stator segments 16a and 16b and shank segments 17a and 17b.

As best seen in FIGS. 3 and 5, the movable blade 20 has a rectangular cross-section and is double-edged, the edges 20a and 20b having relatively wide rectangular teeth or cutting nibs N_w formed therein. The stator segments 16a and 16b, as will be evident in FIG. 5, have a triangular cross-section in order to maintain their rigidity. The stator segments are also double-edged, the edges being slidably chamfered and being slotted to provide relatively fine nibs N_f . In practice, the stator nibs may be .015 inch wide, and the movable blade nibs .030 inch wide.

The finished blade is preferably hardened to Rockwell 83 in the A scale and is diamond finished, the blade being fashioned of Graph-Mo flat stock tool steel $\frac{1}{16}$ of an inch thick. The stator segments are made of high precision

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castings of Graph-Mo steel and hardened to Rockwell 83 in the A scale. The shaving life expectancy of the movable blade is controllable by the degree of hardness imparted thereto in heating treatment.

The head assembly is secured to tubular handle 11 by means of a tapered nut 23 which is received over the conical segments 18a and 18b of the assembly and which threadably engages a bushing 23' force-fitted into the end of the handle. It will be seen that the inner end of nut 23 presses against the shoulder formed between the flange segments 19a and 19b and the conical segments 18a and 18b, thereby retaining the head assembly in place. To dismantle the head assembly one has merely to unscrew nut 23.

The hydraulic reciprocator 12 within the handle is constituted by a barrel 24 force-fitted into a sleeve 25 which in turn is force-fitted into the other end of the tubular handle 11. A plunger 26 is reciprocable within the barrel, the plunger movement being subject to hydraulic pressure. A screw plug 27 encloses the sleeve 25, an O-ring 28 being provided between the bushing and the plug to prevent leakage therebetween. An O-ring 29 is also placed between a shoulder in sleeve 25 and barrel 24 to prevent leakage therebetween.

Hydraulic plunger 26 is connected to a hardened steel extension 30 which is coupled to the plunger by set screws 31 and 32. The movable blade stem 21 is provided with a hole 33, the stem extending within a slot in extension 30 and being linked thereto by a screw 34, preferably of Teflon. Operating clearance for the plunger is indicated at points A₁ and A₂. A helical spring, held in compression is disposed within the conical segments 18a and 18b and surrounds the stem 21 therein. The blade is moved in one direction by pressure applied to the plunger linked thereto and is shifted in the reverse direction by the spring.

The hydraulic reciprocator 14 is identical to reciprocator 12 and includes a sleeve 35, a barrel 36 forced concentrically therein, a plunger 37 movable in the barrel, and a plug 38 enclosing the sleeve. Hydraulic fluid 39 flows between the reciprocators through flexible tube 15. The plunger 37 is connected by a steel extension 40 to a swivel bar 41 fastened to the driving spring armature 42 of the electrical vibrator 13. The vibrator preferably is of the high-amplitude type and is energized by alternating-current whereby assuming 60 cycle current, the vibrator is caused to swing at 7200 cycles per minute. It is to be understood that any frequency of blade movement ranging from one cycle a second to any higher value will produce satisfactory shaving results. With the blade slots and the stator slots as shown, a blade travel of one-eighth of an inch will be adequate to effect the desired shearing action. An increase in travel distance will not enhance or detract from the results. This could therefore be called the terminal parameter. In practice, the blade movement reciprocally should not be less than $\frac{3}{32}$ of an inch and not greater than $\frac{1}{8}$ of an inch. The frequency of motion is not critical. However, the velocity of the blade movement, irrespective of frequency, must be adequate to produce the shear force required for haircutting over the total blade-cutting area of the zone of contact.

The vibrator and the hydraulic reciprocator are both mounted on a common base plate 43. In practice the hydraulic actuator may be mounted in a small box, with a plug provided for connection to an electrical outlet, the fluid line from the box extending to the shaving implement which may be readily manipulated by the user.

In operation, when the vibrator is energized, the plunger 37 is correspondingly reciprocated, thereby causing pulses of hydraulic fluid through tube 15 to activate the plunger 26 in the reciprocator which drives the movable blade 20. Thus, as shown in FIG. 6, the nibs on the

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blade 20 move back and forth with reference to the nibs on the stator segment.

The cutting head makes direct surface contact with the skin, and cutting is effected in relation to both stator segments and the common blade. A hair which protrudes above the skin surface will be nibbled off flush with the skin, and any soft appendage will be pressed down and remain undisturbed. The slots in the stator segments will comb hair into the cutting zone so that the removal of hair is a surface action with results comparable to that produced by safety or open blade razors but with less irritation. There is no guard interposed between the skin and the cutting zone and yet the cutting action is perfectly safe. The shaving head is completely isolated from the electrical system and may be sterilized or cleaned without difficulty. Shaving may be done with or without soap or lather.

While a hydraulic system has been shown to operate the razor, it will be appreciated that any known form of reciprocating drive may be used for this purpose.

Provided on the handle are finger pivots P₁ and P₂ in the form of button type rivets, the axial point of the rivets being at a 90° angle with respect to the cutter faces. In shaving, one rivet rests in the center of the pad of the index finger of the right or left hand and the other rivet in the pad of either thumb. By means of this simple expedient, whereby the instrument may be pivoted from right to left, the correct shaving position may be established automatically with the cutters always in proper shaving position for the entire facial contour.

Provided in the hydraulic reciprocators in the shaver and actuator are oil holes O₁ and O₂. These are used to fill the hydraulic system with oil and are closed with a small screw and O ring seal. One hole acts as a filler and the other as a bleeder or seal port.

While there has been shown what is considered to be a preferred embodiment of the invention, it will be manifest that many changes and modifications may be made therein without departing from the essential spirit of the invention. It is intended, therefore, in the annexed claims to cover all such changes and modifications as fall within the true scope of the invention.

What is claimed is:

1. In a hair-cutting implement, a shaving head assembly comprising a pair of complementary metallic elements so shaped as to define a pair of matched stator segments in parallel relation, a pair of shank segments extending from said stator segments and connected to pair of conical segments terminating in a pair of annular flange segments, a blade interposed between said stator segments slidable longitudinally and provided with a stem, said stem being received within channels formed in said stator segments and said shank segments and extending within said conical segments, said blade and said stator segments having substantially the same transverse dimensions to prevent blade exposure.

2. In a hair-cutting implement, a shaving head assembly comprising a pair of complementary metallic elements so shaped as to define a pair of matched substantially flat stator segments in parallel relation, a pair of shank segments extending from said stator segments and connected to a pair of conical segments terminating in a pair of annular flange segments, a flat blade interposed between said stator segments slidable longitudinally and provided with a stem, said stem being received within channels formed in said stator segments and said shank segments and extending within said conical segments, said blade and said stator segments being double-edged and having nibs therein, the nibs of said blade being relatively fine and the nibs of said stator segments being relatively fine, said blade and said stator segments having substantially the same transverse dimensions to prevent blade exposure.

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