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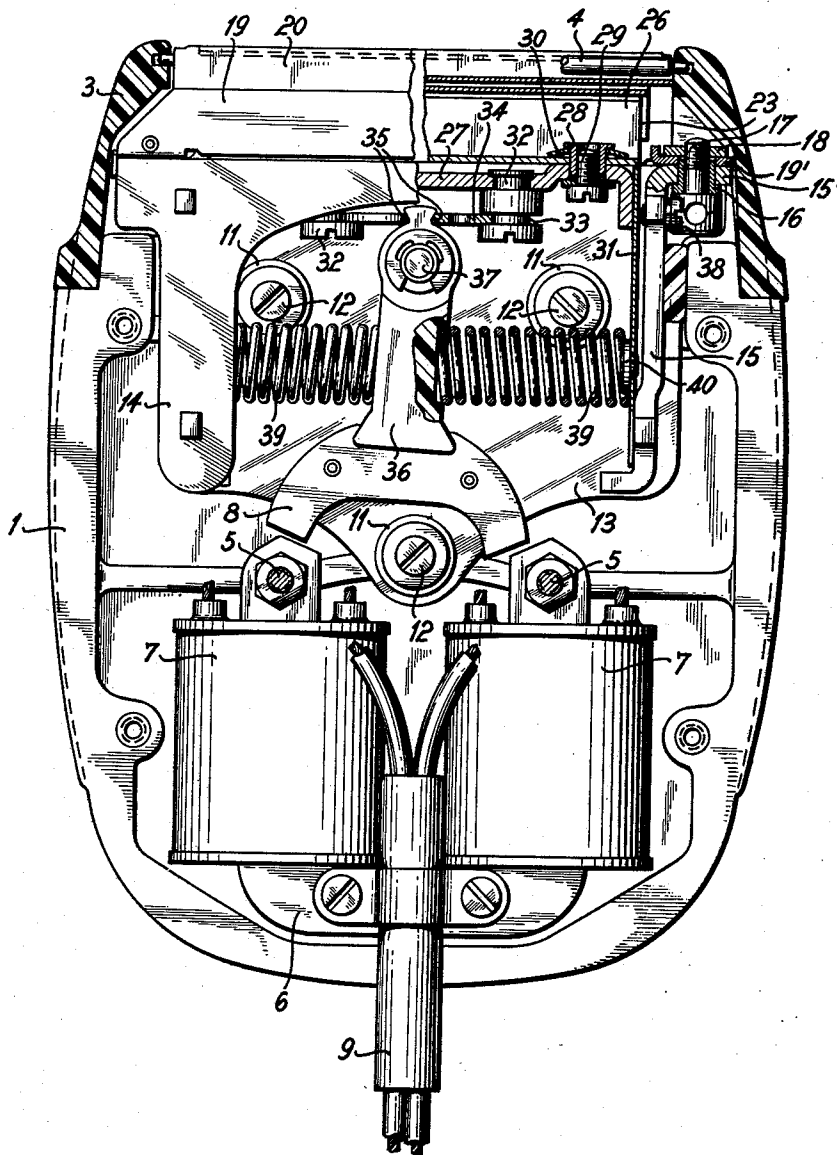
3,065,541

ELECTRIC NIPPER-TYPE DRY SHAVER

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3 Sheets-Sheet 1

FIG. 1



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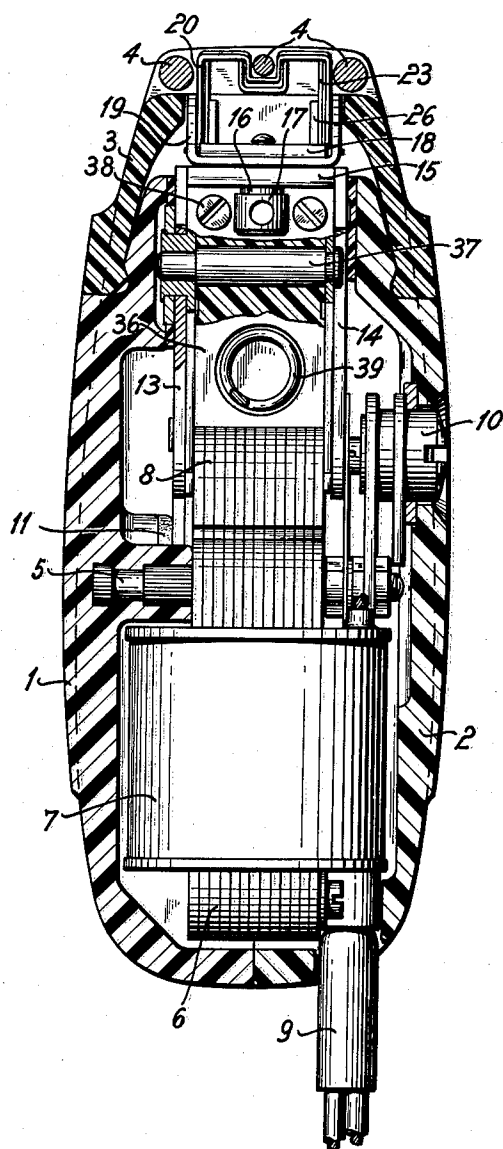
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ELECTRIC NIPPER-TYPE DRY SHAVER

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FIG. 2



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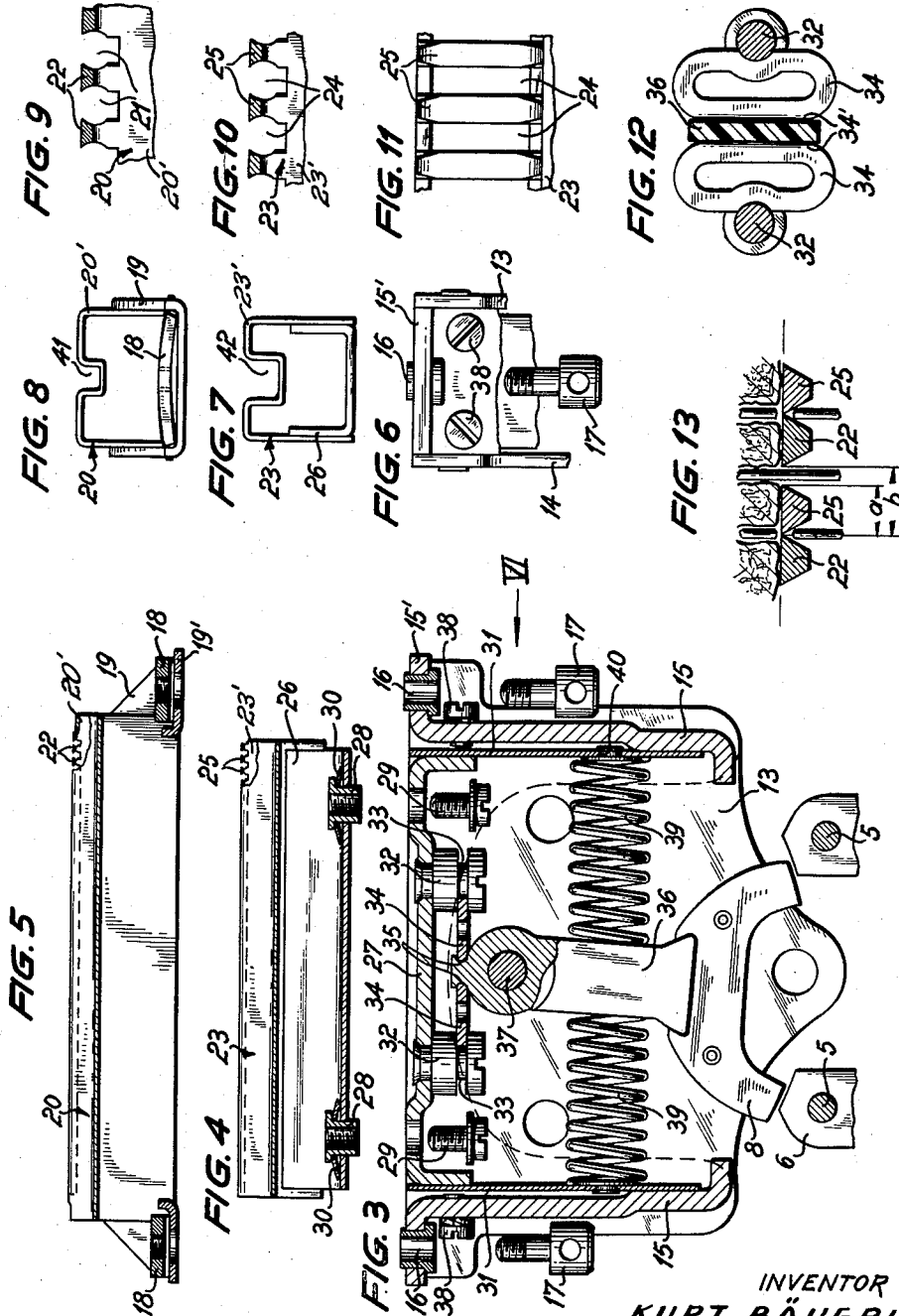
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ELECTRIC NIPPER-TYPE DRY SHAVER

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ELECTRIC NIPPER-TYPE DRY SHAVER
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5 Claims. (Cl. 30-42)

The invention relates to an electric dry shaver. Most conventional devices of this kind operate on the principle of a shearing operation. It is also known, however, that a different principle may be employed in dry shavers, i.e. that of clipping as by a pair of nippers. In this case, the cutting edges of one or more pairs of knives movable towards each other like pincers are outermost and, at least when cutting, in the same plane. In this way, it is possible to avoid the clearance between skin and cutting means that is necessitated in conventional shavers with shearing head by the presence of a shear plate or other thin sheet of material serving as a shearing blade, so that the hairs can be cut off close to the surface of the skin.

Despite this important advantage over shavers with strict shearing operation, dry shavers with pincer-like clipping operation have not yet appeared on the market. There are various reasons for this. If the principle outlined above is applied to devices having only one pair of knives cooperating pincer-fashion, the result is an appliance of simple design and manufacture, but the shaving process is too slow. If the number of pairs of knives is increased for greater effectiveness, then the requirement that the cutting edges of the two jaws must meet very accurately in the act of cutting without deviating upward or downward presents considerable difficulty. In known devices having one stationary and one cutter, the latter movable cutter is slidably mounted under spring action in the stationary cutter to achieve this accurate meeting of the cutting edges. If clearance between the two cutters is eliminated by means of a comparatively powerful spring, or if the slide connection allows virtually no play, there will in either case be severe friction and hence much waste of applied power. The customary comparatively low-power driving means such as electromagnets with oscillating armatures, small electric motors and the like, are therefore unable to develop enough force for the shaving operation proper, i.e. the severing of the hairs.

Another circumstance contributes to this difficulty. In shavers operating on the shearing principle, the holes or slits in the stationary and the moving knives may be so distributed that, at least to some extent, the knives will act successively throughout the cutting stroke. In this way, the force required is diminished to the extent that the usual power systems are adequate. In applying the principle of clipping as by pincers, on the other hand, all blades act at the same instant, so that it is not possible to distribute the power requirement.

The object of the invention is to overcome these difficulties that militate against the use of the principle of clipping the hairs off pincer-fashion. It consists, firstly, in that the shaver comprises two meshing cutters of equal height having transverse teeth or blade members with cutting edges on both sides; one of these cutters, a stationary one, is fixed to the surface of a rigid part of the housing, while the other, a longitudinally movable cutter, is fixed to the surface—in the same plane as the surface of the rigid housing part—of a frame part attached to the fixed part of the housing so as to be restricted reciprocable in cutting direction only, so that the movable cutter is able to reciprocate without friction independently of the stationary cutter, and the cutting edges of both arrays of blade members are always opposed at exactly the same height.

The two cutters slide neither on tracks of their own nor

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in each other; rather, the movable cutter, which is free to move only in cutting direction, reciprocates frictionlessly to and fro.

Friction at points of bearing is eliminated because the stationary cutter of course cannot generate friction and because the longitudinally movable cutter is attached to two leaf springs connected with the housing, the springs forming with the movable cutter a substantially parallelogrammatic linkage which springs holding the cutter freely suspended and without friction in opposition to the stationary cutter while permitting reciprocating movements of the movable cutter exclusively in the cutting directions.

A simple design solution, at the same time permitting accurate and permanent adjustment of the cutting edges relative to each other, consists in that the movable cutting member is fixedly but detachably mounted on the flat top of a bridge member fastened to the leaf springs, and in that the reciprocable linkage consisting of the leaf springs, the bridge member and the movable cutter is mounted, together with the armature of an electromagnet controlling it, in a rigid frame that likewise bears the stationary cutter and is detachably fastened bodily to the housing, preferably by means of rubber sleeves and screws. This construction has the additional advantage in manufacture that those parts of the appliance that require accurate positioning can be produced as separate components and mounted, without special adjustment, on the coplanar top surfaces of the bridge member and the supporting frame.

The same purpose, and that of uniform adjustment of the armature relative to the cutting edges without play, is served if, in further accordance with the invention, the bridge member is fitted with laterally adjustable hardened spring transmission members, preferably attached by means of pins with eccentric circumferential groove, which cooperate elastically, but without play, with a lever connected to the armature of an electromagnet and pivoted in the supporting frame.

Since the lever transmitting the force of the magnet to the movable shaving cutter is mounted in the same supporting frame as the cutters, the relative position of these parts remains completely unaltered in operation.

As mentioned above, the principle applied in the apparatus of the invention, i.e. that of clipping the hairs as by nippers, requires considerable force in the act of cutting. In order to develop this force without having to use more powerful driving means, the arms of the controlling lever, subject to the action of two springs reacting against the leaf springs and tending to hold it in a centered position, are so proportioned that the shorter arm, i.e. the one cooperating with the transmission members, executes reciprocations of only about 0.2 to 0.3 millimeter.

The device according to the invention will now be more fully described with reference to the accompanying drawing, but it should be understood that the same is given merely by way of illustration and not of limitation and that many changes in the details may be made without departing from the spirit of the invention.

In the drawing:

FIG. 1 shows a top view of an embodiment of the invention with cover part removed, in partial longitudinal section;

FIG. 2 shows a sectional side view of the same;

FIG. 3 shows a longitudinal section of the frame assembly;

FIG. 4 is a top view, in partial section, of the moving shaver cutter and its suspension means;

FIG. 5 is a similar view of the stationary cutter;

FIG. 6 is a partial side view in the direction of the arrow VI in FIG. 3;

FIG. 7 is a side view of the movable cutter;

FIG. 8 is a side view of the stationary cutter;

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FIG. 9 is a section, much enlarged, of several teeth of the stationary cutter;

FIG. 10 is a similar view of several teeth of the movable cutter;

FIG. 11 is a partial end view, much enlarged, showing a portion of the movable cutter;

FIG. 12 is a detail of the transmission members; and

FIG. 13 is a greatly enlarged diagram of the cutting operation.

The embodiment shown comprises a housing 1, preferably of insulating synthetic material, and a cover part 2 attachable to it with screws. The head is fitted with a guard member 3 having rollers 4. In the rear part of the housing 1, an electromagnet 6 with coils 7 and oscillating armature 8 is mounted by means of imbedded bolts 5. Current is supplied by a cord 9 fitted in the usual manner with a plug, not shown. The shaver may be set for different supply voltages, for example 110 or 220 volts, by means of a switch 10 mounted on bolt 5.

In front of the magnet system 6, 7, the housing 1 is fitted by means of silencing rubber sleeves 11 and screws 12 with a supporting frame comprising a back plate 13, a front plate 14 cut out archwise, and two lateral end pieces 15 bent over at the top. The plates and pieces constitute the supporting frame. The top tabs of end pieces 15 are fitted with bushings 16, capstan screws 17 and spring washers 18 for attachment of a box-shaped shaving cutter 20 consisting of longitudinal wall portions 19 and a toothed portion 20' (FIGS. 5, 8 and 9) with end tabs 19', made of thin sheet steel, partially open at the ends and bottom, and provided with transverse gaps 21 on top. The teeth 22 left between the gaps are of trapezoidal cross section and ground on their bevel edges, thus forming stationary knives.

Inside the fixed shaving cutter 20, there is a movable cutter 23, likewise box-shaped and open at the ends, consisting of a toothed portion 23' (FIGS. 4, 7 and 10) and a wall portion 26, likewise made of thin sheet steel and having gaps 24 and teeth 25 similar to those of the stationary cutter. The teeth 25 of the moving cutter 23, which are about 0.2 to 0.3 mm. narrower than the gaps 21 in the stationary cutter 20, mesh with these gaps 21 in such a way that the ground cutting edges of the teeth 22 and 25 of the two cutters 20 and 23 are at exactly the same level. Fixed cutter 20 forms first cutter means with first carrier means including the wall portion 19 for its array of blade members, i.e., teeth 22, while the movable cutter 23 forms second cutter means provided with second carrier means including wall portion 26 and respective blade members, i.e. teeth 25.

The moving cutter 23 is rigidly mounted by its under side on a bridge member 27 with the aid of two sleeves 28, two screws 29 and two spring washers 30. The bridge member 27 is attached, for example by riveting or spot welding, to two wide leaf springs 31 attached to the end pieces 15 by spot welding, riveting or screw fastening.

The stationary cutter 20 and the movable cutter 23 form rigid box-shaped hollow members of exactly equal height, and the top bearing surfaces of the bridge member 27 and the lateral tabs 15' of end pieces 15 are exactly flush. It is desirable for all contacting bearing surfaces to be ground. This ensures absolutely accurate meeting of the cutting edges of the two cutters 20 and 23.

In the underside of bridge member 27 are set two slotted or hexagonal-head screws 32, riveted in place and having eccentrically machined annular grooves 33. These are engaged by two similar, slightly resilient, hardened transmission members 34, whose inward edges 34' are preferably rounded and engaged by grooves 35 on either side of the upper, short arm of a lever 36. By turning screws 32, the eccentric grooves 33 can be made to shift the transmission members 34 laterally into sung engagement with the grooves 35, thus mutually adjusting lever 36 and the movable inner cutter 23.

Lever 36 is attached to plate 13 by a pivot pin 37, and

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its lower, long arm bears the armature 8 of the magnet system 6, 7. The top arm of lever 36 is so proportioned to the lower arm that when lever 36 and armature 8 reciprocate, it will execute reciprocations of only about 0.2 to 0.3 mm. The reciprocations produced by lever 36 on the part of the moving cutter 23 are end stopped by setscrews 38 in end pieces 15, cooperating with leaf springs 31. Lever 36 is restored to neutral by two coil springs 39 reacting against leaf springs 31 or end pieces 15 and secured to them by means of clips 40.

As FIGS. 7 and 8 show, the two cutters 20 and 23 are provided with central lengthwise channels 41 and 42, approximately rectangular, leaving two rows of successive cutting teeth 22 and 25 on either side, thus providing double shaving action in passing over the skin to be shaved, as well as more effective skin tension.

The gaps 21 and 24, teeth 22 and 25, and dimensions of cutters 20 and 23 are so laid out that no frictional contact occurs anywhere. Instead, the teeth 25 which act as hair clippers reciprocate freely in the gaps 21 of the stationary cutter 20, between the teeth 22 of the latter. The resulting cutting action is illustrated in FIG. 13. Hairs entering gaps 21 and 24 (seen in FIGS. 9 and 1) as the shaver is moved laterally are clipped off between meeting cutting edges of teeth 22 and 25. As these cutting edges are at the extreme exterior, and the whiskers are consequently severed next to the skin, an usually clean shave is obtained.

Since the width a of teeth 25 is about 0.2 to 0.3 mm. less than the distance b between teeth 22, hairs are able to enter between the cutting edges without difficulty, but injury to the skin is not possible even when the shaver is held tight against it.

What I claim is:

1. In a dry shaver, in combination, a housing; first cutter means supported within said housing, said first cutter means comprising an elongated first carrier member and a first array of spaced-apart blade members extending from said housing and defining a cutting surface; second cutter means spaced from said first cutter means within said housing, said second cutter means comprising an elongated second carrier member and a second array of blade members interleaved with clearance between the blade members of said first array and terminating at said cutting surface for reciprocating motion parallel thereto relative to said first array; a parallel-motion linkage including resilient means supporting said second cutter means with freedom from frictional engagement with said first cutter means for reciprocating displacement of said second array along said surface and substantially only in the plane of said second array; and motive-power means within said housing for reciprocating said second cutter means.

2. In a dry shaver, in combination, a housing; stationary cutter means rigidly supported within said housing, said stationary cutter means comprising an elongated first carrier member and a first array of spaced-apart blade members extending from said housing and defining a cutting surface; movable cutter means spaced from said stationary cutter means within said housing, said movable cutter means comprising an elongated second carrier member and a second array of blade members interleaved with clearance between the blade members of said first array and terminating at said cutting surface for reciprocating motion parallel thereto relative to said first array; a parallel-motion linkage including resilient means supporting said movable cutter means with freedom from frictional engagement with said stationary cutter means for reciprocating displacement of said second array along said surface and substantially only in the plane of said second array; and motive-power means within said housing for reciprocating said movable cutter means.

3. In a dry shaver, in combination, a housing; stationary cutter means rigidly supported within said hous-

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ing, said stationary cutter means comprising an elongated first carrier member and a first array of spaced-apart blade members extending from said housing and defining a cutting surface; movable cutter means spaced from said stationary cutter means within said housing, said movable cutter means comprising an elongated second carrier member and a second array of blade members interleaved with clearance between the blade members of said first array and terminating at said cutting surface for reciprocating motion parallel thereto relative to said first array; a parallel-motion linkage including resilient means supporting said movable cutter means with freedom from frictional engagement with said stationary cutter means for reciprocating displacement of said second array along said surface and substantially only in the plane of said second array; and motive-power means within said housing for reciprocating said movable cutter means, said resilient means constituting a pair of substantially inextensible elongated resilient arms of said linkage, secured to said second carrier member at longitudinally opposite extremities thereof and to said housing at spaced locations.

4. In a dry shaver, in combination, a housing; stationary cutter means rigidly supported within said housing, said stationary cutter means comprising an elongated first carrier member and a first array of spaced-apart blade members extending from said housing and defining a cutting surface; movable cutter means spaced from said stationary cutter means within said housing, said movable cutter means comprising an elongated second carrier member and a second array of blade members interleaved with clearance between the blade members of said first array and terminating at said cutting surface for reciprocating motion parallel thereto relative to said first array; a parallelogrammatic linkage including resilient means supporting said movable cutter means with freedom from frictional engagement with said stationary cutter means for reciprocating displacement of said second array along said surface and substantially only in the plane of said second array; and motive-power means within said housing for reciprocating said movable cutter means, said resilient means constituting a pair of substantially inextensible leaf springs forming arms of said linkage, said leaf springs being secured to said second carrier member at longitudinally opposite extremities thereof and to said housing at spaced locations and being flexible substantially only in directions of reciprocation of said movable cutter means.

5. In a dry shaver, in combination, a housing; stationary first cutter means rigidly supported within said

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housing, said stationary cutter means comprising an elongated first carrier member and a first array of spaced-apart blade members extending from said housing and defining a cutting surface; movable cutter means spaced from said stationary cutter means within said housing, said movable cutter means comprising an elongated second carrier member and a second array of blade members interleaved with clearance between the blade members of said first array and terminating at said cutting surface for reciprocating motion parallel thereto relative to said first array; a parallel-motion linkage including resilient means detachably engaging said movable cutter means and floatingly supporting said movable cutter means with freedom from frictional engagement with said stationary cutter means for reciprocating displacement of said second array along said surface and substantially only in the plane of said second array; and motive-power means within said housing for reciprocating said movable cutter means, said resilient means constituting a pair of substantially inextensible leaf springs forming arms of said linkage, said leaf springs being secured to said second carrier member at longitudinally opposite extremities thereof and to said housing at spaced locations and being flexible substantially only in directions of reciprocation of said movable cutter means.

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