



Dec. 24, 1968

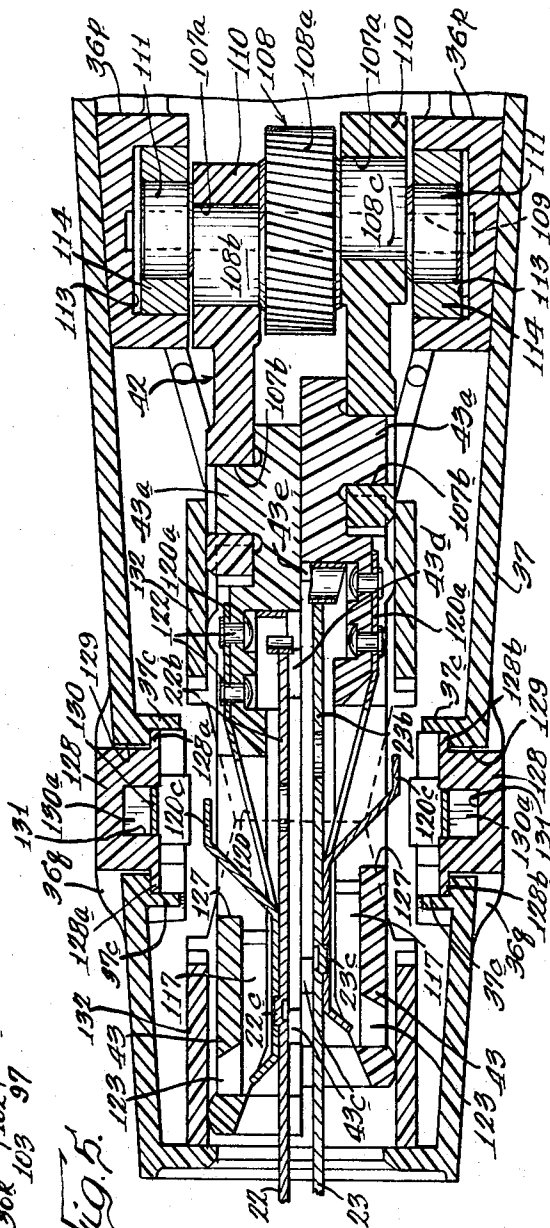
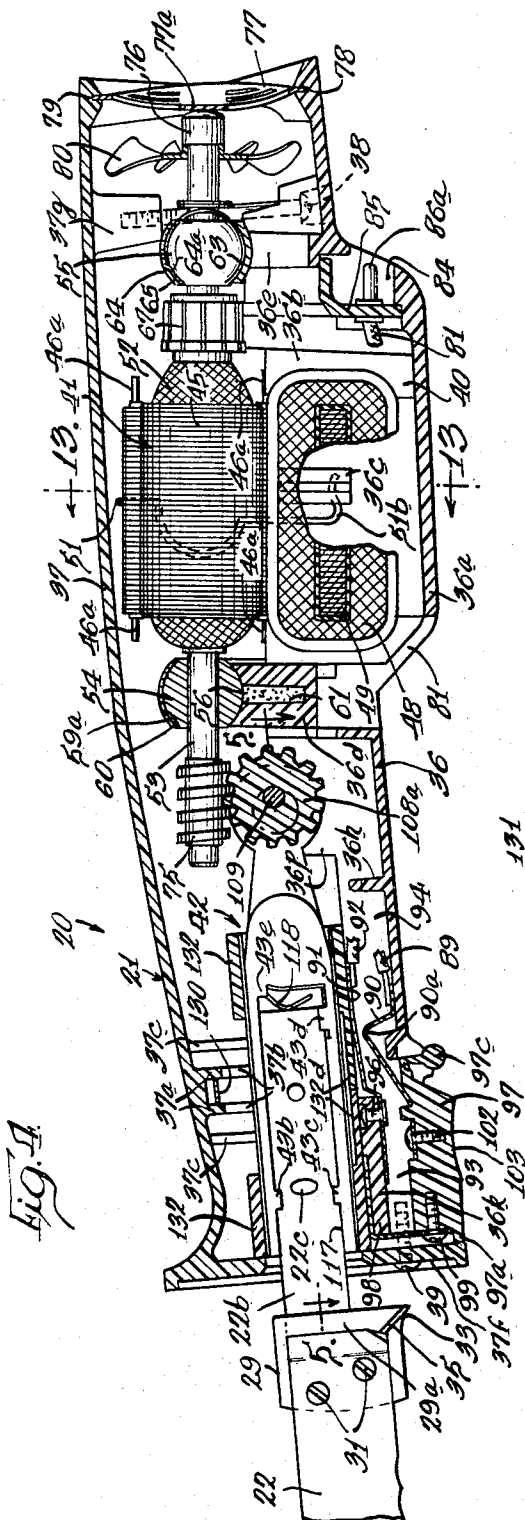
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ELECTRIC KNIFE

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Fig. 6.

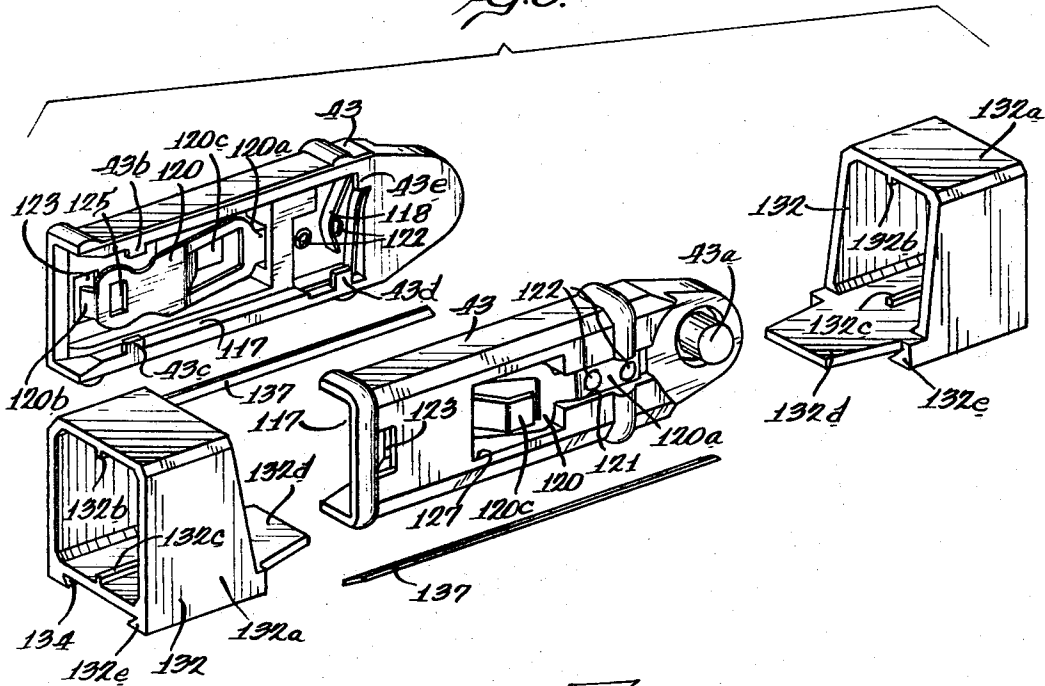
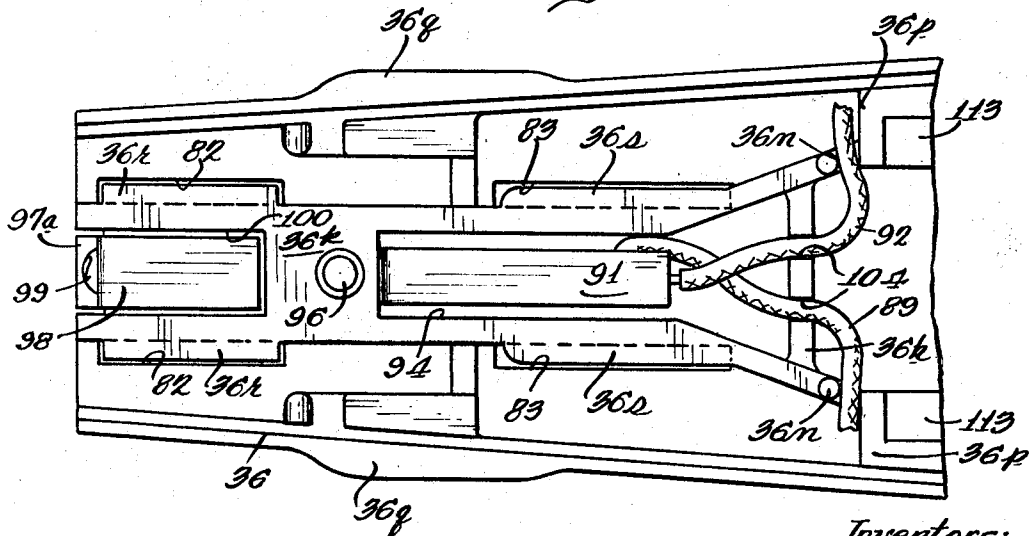


Fig. 7.



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Fig. 10.

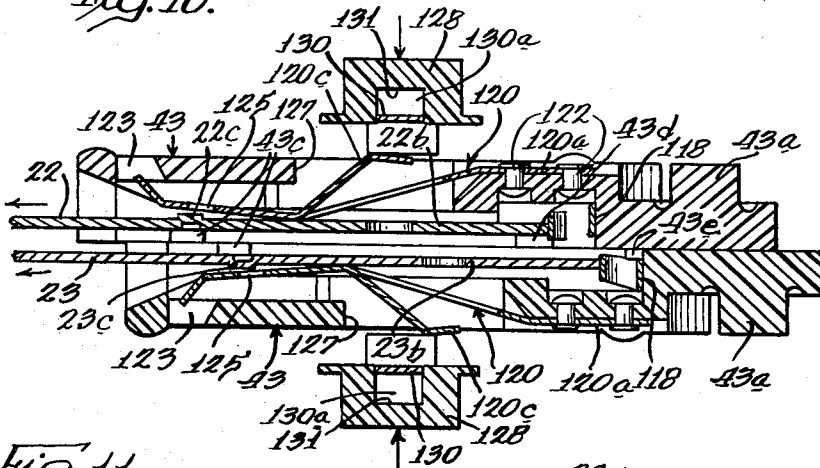


Fig. 11

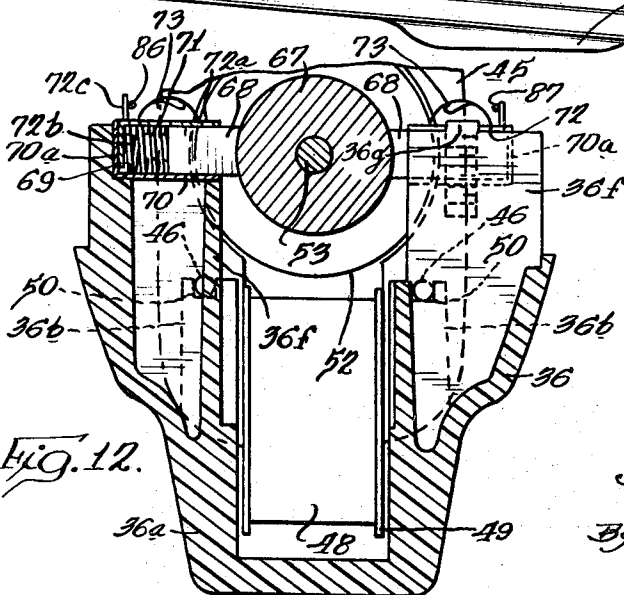
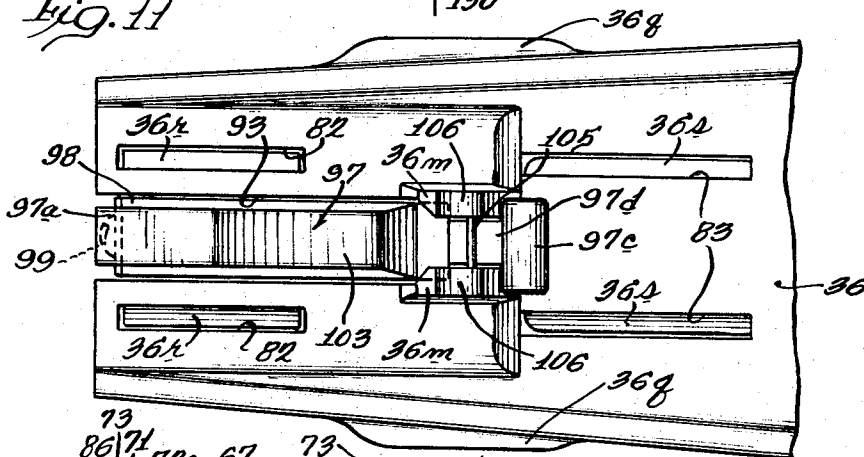


Fig. 14.

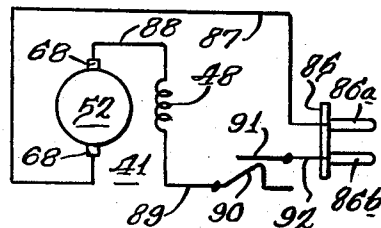


Fig. 12.

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## ELECTRIC KNIFE

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### ABSTRACT OF THE DISCLOSURE

Electrically operated slicing knife with a hollow handle housing an electric motor and means to convert rotary motion of the motor to counterreciprocating motion of a pair of identical blade holders molded from suitable plastic. A pair of knife blades are each adapted to be releasably secured to an associated one of the blade holders. A pair of resilient members, one secured to each of said blade holders are each provided with latching means to releasably latch each blade to its associated holder. An intermediate portion of each resilient member serves as a fulcrum when a releasing force is applied to the resilient member. A trigger for energizing the motor is provided together with latch means to prevent actuation of the trigger.

The present invention relates to a power operated knife and, more particularly, to what might be termed an electric knife or an electric slicing and carving knife.

During the last two years, electric knives have become quite popular, and a large number of manufacturers are presently marketing such knives. Most of these knives comprise a pair of blades releasably secured together and reciprocated by a suitable electric motor contained in a power unit in sliding contact with each other. It is obvious that the knives should be readily removable from the power unit for cleaning purposes and yet securely attached thereto when used to perform a cutting operation.

It has been determined that a consumer wants an electric knife which is light in weight, has the proper balance and will provide fast cutting at all times. Moreover, such knives should permit easy blade removal, and the blades should stay sharp and be designed to trim and cut around bones. Additionally, such knives should be provided with safety means so that they cannot be energized accidentally, particularly when inserting and removing the blades. The presently available electric knives do not fulfill such consumer's wants and are deficient in many respects.

Accordingly, it is an object of the present invention to provide a new and improved electric knife.

It is another object of the present invention to provide an improved electric knife with a drive mechanism which imparts a reciprocating motion to the cutting means.

It is still another object of the present invention to provide an improved electric knife which is simple and compact, is foolproof in operation and capable of giving years of satisfactory service to the user.

It is a further object of the present invention to provide a hand held power operated slicing knife of the type employing two counterreciprocating blades having an improved drive mechanism and an improved means for releasably securing the blades to the drive mechanism.

Still another object of the present invention resides in improved latching and releasing means for rigidly securing a pair of knife blades to drive means for causing reciprocation of said blades in sliding contact with each other.

A further object of the present invention resides in the provision of a lightweight electric knife which is properly balanced, easy to maneuver by the user and which is pleasing to the hand and comfortable to use.

Another object of the present invention resides in the provision of an electric knife with an improved motor

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and blade action which combine to deliver a speed faster than that of presently known electric knives.

It is still another object of the present invention to provide an electric knife with improved means for preventing liquid or food particles from moving beyond the portion of the knife used to perform the cutting action.

Yet another object of the present invention resides in safety means for insuring manipulation and removal of the knife blades of an electric knife with complete safety and without touching the cutting surfaces.

A still further object of the present invention resides in improved and compact mounting means for the power and drive mechanisms of an electric knife so as to permit ready assembly and disassembly and low manufacturing cost.

A further object of the present invention resides in improved cutting blades for an electric knife which will remain sharp for many years and which place a minimum load on the electric motor actuating the same.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIG. 1 is a perspective view of the electric knife of the present invention with the blades assembled with the power unit ready for a cutting or slicing operation;

FIG. 2 is an enlarged top plan view of the power unit of FIG. 1 with the upper portion of the casing removed but with the blade release buttons and part of the spring for such buttons shown, but with only a small portion of the blades being shown;

FIG. 3 is a fragmentary perspective view of the free end of the blades viewed from the side opposite that shown in FIG. 1;

FIG. 4 is a sectional view with certain portions cut away taken on line 4—4 of FIG. 2 assuming that FIG. 2 shows the complete structure and further illustrating the switch trigger in the locked position;

FIG. 5 is an enlarged fragmentary sectional view taken on line 5—5 of FIG. 4 assuming that FIG. 4 shows the complete structure;

FIG. 6 is an enlarged exploded perspective view of the blade holder assemblies and the blade holder guides of the electric knife of FIG. 1;

FIG. 7 is an enlarged fragmentary view of a portion of FIG. 2 but with the blade release buttons, the blade holder assemblies and the blade holder guides removed;

FIG. 8 is an enlarged fragmentary view of a portion of FIG. 4 of the drawings but with the knife blades removed and with the switch trigger in the unlocked position;

FIG. 9 is a sectional view taken on line 9—9 of FIG. 8 assuming that FIG. 8 shows the complete structure but with the knife blades removed;

FIG. 10 is a fragmentary view similar to FIG. 5, but with certain portions omitted, illustrating the blade springs and the blade release buttons at the moment they are actuated to permit removal of the knife blades;

FIG. 11 is a fragmentary bottom view of FIG. 8 assuming that FIG. 8 shows the complete structure;

FIG. 12 is an enlarged sectional view taken on line 12—12 of FIG. 2 assuming that FIG. 2 shows the complete structure except for the top casing section;

FIG. 13 is an enlarged fragmentary sectional view taken on line 13—13 of FIG. 4 again assuming that FIG. 4 shows the complete structure; and

FIG. 14 is a schematic diagram illustrating the electrical circuit of the electric knife of the present invention.

Briefly, the present invention is concerned with an electric knife including a two-part casing within which is mounted an electric motor and a drive mechanism for converting rotary motion of the armature shaft of the electric motor to counterreciprocating motion of a pair of blades disposed in intimate sliding contact with each other. Improved locking or latching means for firmly securing the blades to the drive mechanism and yet permitting ready release thereof for cleaning are provided. Improved means for preventing food particles, grease and the like from reaching the power unit is also provided, as is a safe electrical circuit which insures that the motor will not be operated when the knives are being applied or removed. Moreover, a lightweight knife with improved balance, improved maneuverability and the like is also provided.

Referring now to the drawings, there is illustrated a power operated slicing knife generally designated by the reference numeral 20 comprising a power unit generally designated at 21 for reciprocating in sliding engagement with each other a pair of knife blades 22 and 23. The knife blades 22 and 23 are preferably formed of stainless steel and precision honed so as to be razor sharp. Preferably, they are provided with serrated cutting edges designated at 24 and clearly indicated in FIGS. 1 and 3 of the drawings. Additionally, they may be provided with a tungsten carbide coating on the outside of the blades and the tip. Such coating should not be applied to the inside of the blades since it will provide a drag by virtue of the fact that these blades have their inside surfaces in rubbing contact. To facilitate carving around bones and the like, the tip of each blade 22 and 23 is curved to provide sharp points 22a and 23a, respectively, immediately adjacent the cutting edges thereof.

For the purpose of holding the forward portions of the blades 22 and 23 in intimate sliding contact, any conventional readily removable interconnecting means may be employed such, for example, as a keyhole slot and rivet arrangement, best shown in FIG. 3 of the drawings. As illustrated, the blade 23 is provided with a projecting rivet 26 and the blade 22 is provided with a keyhole slot 27. With this arrangement the blades can readily be assembled for use or disassembled for cleaning purposes. Except for the interconnecting means 26 and 27, the blades 22 and 23 are essentially mirror images of each other. The ends of the blades 22 and 23 remote from the tips 22a and 23a terminate in tangs 22b and 23b, respectively. These tangs are each of rectangular configuration, as best shown with respect to the tang 22b in FIG. 4 of the drawings, so as to be receivable and capable of firm support in a suitable blade holder, described in detail hereinafter. Moreover, each tang 22b and 23b is provided with an oval projection 22c and 23c, respectively, (FIGS. 4, 5 and 10) which serves as detent means for releasably securing the blades to the power unit 21, as described hereinafter. Preferably, the projections 22c and 23c are formed by a deforming operation and, of course, are integral with the blades 22 and 23, respectively.

It will be understood that the blades of an electric slicing or carving knife are likely to be quite greasy under certain conditions of use. In order to facilitate removal of the blades 22 and 23 when greasy or otherwise quite slippery, there is secured to the outside face of each blade a plastic finger engaging member which also functions as a drip guard. As illustrated, there is secured to the blade 22 a somewhat rectangular drip guard and finger engaging member 29, and to the blade 23 a similar guard 30. These guards 29 and 30, like the associated blades 22 and 23, are also mirror images of each other and are preferably molded of a suitable grease resistant plastic. They are secured to their associated blade by suitable fastening means such as 31 (FIG. 4). So that these guards are readily engageable by the fingers of the user, each is preferably provided on its outside face with a finger engaging depression 32 (FIG. 1). Thus, there is no necessity

of touching the cutting portions of the blades when inserting or removing them from the power unit. As illustrated, the bottom edge of each guard, which is generally parallel with the cutting edge of the associated blade, curves downwardly at the lower rear corner as indicated at 33 (FIGS. 1 and 4) whereby grease or liquid will drip therefrom rather than move onto the tang of the knife when the blades 22 and 23 are elevated relative to the power unit 21.

To prevent liquid or grease which has gathered on the two adjacent surfaces of the knife blades 22 and 23, which are in intimate sliding contact, from moving rearwardly by capillary action between the blades toward the tangs and, hence, into the power unit 21, each of the guards 29 and 30 is provided with a narrow integral strip extending across the inside face of its associated blade 22 and 23. This strip or grease barrier designated at 29a for the guard 29 is best shown in FIG. 4 of the drawings. The grease barriers 29a and 30a stop the flow of such grease from reaching the tangs 22b and 23b of the blades 22 and 23, respectively. A suitable diagonally disposed slit 35 (FIG. 4) is provided in each guard 29 and 30, as best shown in FIG. 4, so that any grease which reaches barriers 29a and 30a may escape before moving into the power unit 21. The blades 22 and 23 are so shaped that the inside grease stops 29a and 30a of the guards 29 and 30 will not interfere with the blades being in intimate contact throughout the cutting length thereof. In other words, the tang portions 22b and 23b are offset laterally to a small extent with respect to the major portion of the blades 22 and 23 to accommodate the stop portions 29a and 30a of the juice guards 29 and 30.

The power unit 21 is illustrated as a very small compact structure which preferably is also light in weight so that it may readily be grasped and manipulated by the hand of the user. In a device built in accordance with the present invention, the power unit 21 with the blades 22 and 23 inserted weighed less than twenty-two ounces. Obviously, the power unit 21 may be a self-contained unit including a suitable battery for energizing an electric motor. In the illustrated embodiment, however, the power unit 21 includes an electric motor adapted to be connected by the usual power cord to a conventional source of electrical energy. The power unit 21 of the present invention comprises a casing defined by a base member or base 36 and a cover member 37 which are adapted to be suitably secured together by fastening means 38 and 39 (FIGS. 4 and 8). Disposed within the chamber 40 defined by this casing is an electric motor generally designated at 41, a drive mechanism generally designated at 42 for converting rotary motion of the motor 41 to reciprocating motion, and a pair of identical blade holders 43 alternately reciprocated by the drive mechanism 42. The parts are disposed within the chamber 40, and the casing is so styled as to provide overall "feel" and balance which is pleasing to the hand comfortable in use.

For the purpose of supporting the elements of the power unit in a compact, easy to assemble structure, the base or lower casing section 36 is formed of a suitable molded plastic and of a one-piece construction with integral supporting means to support the various elements of the electric knife, described in detail hereinafter. During a slicing or carving operation, the user often wishes to put the knife down momentarily. To this end an intermediate portion of the base 36 is provided with a depending section 36a (FIGS. 1 and 4) defining a flat bottom surface of substantial area upon which the power unit 21 may rest when placed on any suitable supporting surface. The depending portion, of course, provides an increased casing area to the rear of where the user usually grasps the same thereby defining a larger chamber 40 than would otherwise be the case.

Instead of first describing in detail the various projections, posts, ledges, etc. defined as an integral part of the base 36, the ensuing description will describe the various

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elements of the power unit 21 and the particular manner in which the same are supported by or secured to the base 36 whereby the details of the base 36 will readily become apparent. Considering first the electric motor 41, it comprises a field structure 45 formed of a plurality of U-shaped laminations (FIGS. 2, 4 and 13) clamped in assembled relationship by a plurality of spaced pins 46 and associated washers riveted thereto, four such pins being employed in an embodiment built in accordance with the present invention. As illustrated, the ends of the pins designated at 46a project beyond the ends of the laminations and the washers so that the two lower pins at least may also function as supporting means for the motor field structure. A suitable field winding 48 is mounted on the bight portion of the U-shaped laminations. Preferably, an insulating spool 49 separates the winding 48 from the laminations.

In order to support the field structure 45 and the associated winding 48, the base 36 is provided with four spaced upwardly extending integral pillars or posts 36b (FIGS. 2, 4 and 12), the tops of which are provided with notches 50 to receive the four ends 46a of the lower two pins 46 (best shown in FIG. 12) and thus firmly support the field structure and winding in an accurately determined position relative to the base 36. The field structure is firmly secured to the base 36 by means of a bail-type retainer or clamp 51, FIGS. 2 and 4, of somewhat U-shaped configuration, the bight 51a of the U extending across the top of the field structure and the ends of the legs of the U terminating in hook-shaped portions 51b engageable with suitable ears 36c (FIGS. 2, 4 and 13) integrally formed with the base 36.

To complete the motor structure, motor 40 includes a rotatable armature 52 suitably mounted on an armature shaft 53. For the purpose of properly supporting this armature shaft 53 so that armature 52 may rotate relative to the field structure 45 and within the U-shaped laminations thereof, there is provided a front bearing 54 and a rear bearing 55. To support the bearing 54, the base 36 is provided with an integral upstanding bearing supporting structure 36d (FIG. 4) having a somewhat spherical recess 56 at the upper surface. The front bearing 54 is held in recess 56 by a suitable somewhat U-shaped bearing retainer 59 secured to the supporting structure 36d by suitable fastening means 58. To prevent rotation of bearing 54 in recess 56, the retainer 59 is provided with a tab 59a receivable in a notch or recess 60 in the bearing 54 (FIG. 4). Preferably, the structure 36d includes a wick retaining recess 61 to insure proper lubrication of the bearing 54.

In order to support the rear bearing 55, base 36 is provided with a pair of spaced integral upstanding posts 36e (only one visible in FIG. 4) for supporting thereupon a metal strap or support member 63 having a central upwardly directed shallow spherical recess for receiving the rear bearing 55 therein. A suitable U-shaped bearing retainer 64 is secured to the posts 36e by fastening means 66 (FIG. 2) which hold both the support 63 and the U-shaped bearing retainer 64 in assembled relationship. This bearing retainer is also provided with an integral tab 64a receivable in a notch or recess 65 (FIG. 4) in bearing 55 to maintain the latter in proper position.

A suitable commutator 67 (FIGS. 2, 4 and 12) is mounted on the armature shaft 53 in a conventional manner and is illustrated as being disposed between the armature 52 and the rear bearing 55.

To support suitable brushes 68 for engaging the commutator 67, the base is provided with a pair of integral vertically extending hollow brush supporting posts 36f (FIGS. 2, 4 and 12). The upper portion of each post 36f is provided with a recess 69 to receive a boxlike brush retainer 70 formed of good electrical conducting material and of a size to slidably receive the associated brush 68 therein. Each brush retainer 70 is open at the top and at the commutator end, as best shown in FIG. 12 of the

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drawings. Each retainer 70 is restrained against movement radially of the armature 52 by tablike extensions from each end of the outer end wall 70a of each retainer 70, which extensions are received in cooperating slots formed in post 36f. Each brush 68 is slidably mounted in its retainer 70 and biased toward the commutator 67 by suitable springs 71.

For the purpose of making electrical connections with the brushes 68 and to close the opening at the top of each retainer 70, a somewhat T-shaped terminal plate 72 is provided for each brush retainer 70 which is secured to the top of the post 36f by a single fastening means 73 (FIG. 2). The leg 72a of the T of terminal plate 72 closes the open top of retainer 70 while one side 72b of the head of the T of terminal plate 72 engages the outer end wall 70a of retainer 70, as clearly shown in FIG. 12 of the drawings. The other side 72c of the head of the T of terminal plate 72 extends upwardly and defines a brush terminal with which electrical connection can readily be made. As illustrated, portion 72a of each terminal plate 72 is provided with a pair of edge notches, one of which receives the associated fastening means 73 and the other receives an integral projection 36g (FIGS. 2 and 12) extending above the top of the associated post 36f, whereby a single fastening means 73 holds each terminal plate in position and electrically connects it with its associated brush guide 70 which, in turn, is intimately associated and electrically connected with its respective brush 68.

In order to transmit rotary motion of the armature shaft 53 to counterreciprocating motion of the blades 22 and 23, the end of the armature shaft projecting beyond the front bearing 54 is provided with a worm gear 75 (FIGS. 2 and 4) which may be integrally formed with the shaft, if desired. It will be understood that by virtue of the worm gear drive an end thrust will be applied to the armature shaft, and to this end the opposite end of the armature shaft is provided with an end thrust bearing 76 which is adapted to engage a rear end closure plate 77 for the casing defined by base member 36 and cover 37, such closure plate taking the end thrust. As illustrated in the drawings, the end closure plate 77 is provided with a grill-like portion to permit cooling air to flow through the chamber 40 defined within said casing. A rim surrounding the grill-like portion of closure plate 77 is receivable within complementary grooves 78 and 79 (FIGS. 2 and 4) defined in the base member 36 and cover member 37, respectively. To provide a somewhat resilient thrust, the closure plate 77 is of somewhat concave construction, as clearly shown in FIGS. 2 and 4 of the drawings, and is provided with a solid central portion 77a (FIG. 4) engageable by the thrust bearing 76.

To aid in cooling the motor, a suitable fan 80 is preferably secured to the armature shaft 53 adjacent the end thrust bearing 76, as best shown in FIGS. 2 and 4 of the drawings. Air for cooling electric motor 41 is drawn by fan 80 into the casing defining chamber 40 through a plurality of openings or slits 81 (FIG. 4) defined in the forward end of depending base portion 36a as well as openings or slits 82 and 83 (FIGS. 7 and 11) defined in base member 36 near the front end thereof, and this air is exhausted through the grill portion of closure plate 77.

In order to simplify the storage problem, it is desirable that the electric knife 20 be provided with a removable power cord. To this end the rear of the depending casing section 36a of base member 36 is provided with an opening 84 (FIG. 4) which is opposite the air slits 81. Suitable grooves and shoulder means are defined in the base member 36 around the opening 84 to support an L-shaped insulating terminal board 85 which rigidly supports a pair of male terminals 86 specifically designated at 86a and 86b (FIGS. 4 and 14). Only the terminal member 86a is visible in FIG. 4 of the drawings. It will be understood that a conventional female-type plug connector can readily be inserted into the opening 84 electrically to engage the terminals 86 in a manner well understood by those skilled in the art.



For the purpose of selectively energizing the motor 41 from a source of electric power supplied to the terminals 86a and 86b, there is provided an electric circuit, as illustrated in FIG. 14 of the drawings, which comprises a conductor 87 (also visible on FIG. 2 of the drawings) which extends from the terminal 86a to one of the brushes 68 and specifically the associated brush terminal 72 thereof. The other brush terminal plate 72 is connected by a conductor 88 (also visible in FIG. 2 of the drawings) with one terminal of the motor winding 48. The other terminal of the motor winding 48 is connected by a conductor 89 (FIGS. 2, 7, 8 and 14) with a movable switch contact 90 engageable with a stationary switch contact 91 (FIGS. 4, 7 and 8). To complete the electric circuit, the stationary contact 91 is connected by a conductor 92 with the terminal pin 86b. It will readily be apparent from FIG. 14 of the drawings that when the switch comprising movable contact 90 and stationary contact 91 is closed the motor 41 will be energized.

To support the stationary switch contact 91, the base member 36 is provided at the forward underside thereof with wall portions defining a downwardly directed recess 93 and to the rear thereof with wall portions defining an upwardly directed recess 94 (FIGS. 4, 7, 8, 9 and 11), the rear portion of the recess 94 being defined by an upwardly projecting wall portion 36h. These recesses 93 and 94 are aligned and interconnected, as best shown in FIG. 8 of the drawings. The top of the recess 93 is defined by a wall portion 36k (FIGS. 4, 7, 8 and 9 of the drawings) molded integrally with base member 36. The wall portion 36k defines suitable means for supporting from the underside thereof stationary contact 91, and as illustrated, one end of stationary contact 91 is secured as by rivet means 96 to the underside of the wall portion 36k within downwardly directed recess 93, whereby the other end of stationary contact 91 may project into the upwardly directed recess 94, the free end thereof being illustrated as connected with the conductor 92 (FIGS. 2, 7 and 8).

In order selectively to actuate the movable contact 90 and, furthermore, to support the same within the recess 94 so as to be capable of movement into engagement with the stationary contact 91, there is provided a switch actuator or trigger 97 which is adapted to be pivotally mounted within the downwardly directed recess 93 so as to project below the base member 36 in a manner readily engageable by the fingers and particularly the forefinger of the user of the knife. The switch trigger 97 is preferably molded from a suitable plastic material preferably of a color different from that of the base member 36 and cover member 37. As illustrated, the switch trigger 97 is provided at its supported end by a lip or projection 97a engageable by one end of a suitable L-shaped spring member 98, one leg of the L engaging the shoulder defined by the lip 97a, as best shown in FIGS. 4 and 8 of the drawings. A suitable screw or other fastening means 99 secures the L-shaped supporting spring to the end of the trigger switch 97. Preferably, the top surface of the wall portion 36k is provided with a shallow recess 100 (FIGS. 7 and 8 of the drawings) for receiving the other leg of the L-shaped pivot spring 98 when the electric knife is fully assembled. As shown in FIGS. 4 and 8 of the drawings, the leg of the spring 98 disposed in recess 100 is held in place in recess 100 by means described hereinafter, whereby the trigger switch 97 has the forward end thereof supported in cantilever fashion. Moreover, the inherent resilience of L-shaped spring 98 biases switch trigger 97 in a clockwise direction, as viewed in FIG. 8 of the drawings.

In order to secure the movable switch contact 90 to the switch trigger 97 by a single fastening means designated at 102, the trigger is provided with an integral projection 97b which extends through a suitable opening in the contact 90. The contact 90, as best shown in FIG. 8 of the drawings, is provided with a V-shaped intermediate section 90a with the point of the V directed upwardly toward

the stationary contact 91. The conductor 89 is suitably secured as by soldering to the free end of the movable contact 90. Preferably and as also best shown in FIG. 8 of the drawings, the switch trigger 97 has a downwardly directed concavity 103 defining a shallow finger engaging recess adjacent the movable end thereof to facilitate actuation by the user.

To provide the safety feature of the present invention so that the switch trigger 97 may be locked against accidental actuation, the latter is provided on the movable end thereof with a cylindrical finger engaging projection 97c connected to the rest of the trigger by a thin flexible section 97d (FIGS. 4, 8 and 11). The portion 97c extends outside the bottom of base member 36 substantially at the junction of the downwardly directed recess 93 and the upwardly directed recess 94. The flexible section 97d, however, is disposed between a pair of spaced downwardly directed projections 36m integral with the base 36. A suitable wire 105 which may be molded into the base 36 so as to extend across the space between the projections 36m defines a stop engageable by portion 97d of trigger switch 97 to limit the maximum clockwise movement thereof caused by the bias of spring 98. The spaced projections 36m bridged by the wire 105 are each provided at their lower extremities with downwardly directed notches 106 whereby the ends of cylindrical projection 97c may be received therein by moving it from the position shown in FIGS. 8 and 11 of the drawings to the position shown in FIG. 4 of the drawings, whereby the switch trigger 97 is locked in the open switch position. It will be apparent from the above description that there has been provided a very simple means for insuring that the user may lock the switch comprising contacts 90 and 91 in the open position particularly while attaching or removing the blades 22 and 23 from the power unit 21.

So that the conductors 89 and 92 may extend from the recess 94 through the wall or barrier 36h without interfering with the drive mechanism 42, the wall 36h is provided with a pair of notches 104 (FIG. 7) for receiving these conductors 89 and 92. Also preferably a pair of projecting posts 36n, FIGS. 2 and 7, further guide these conductors to insure that they are kept free of the moving parts of the drive mechanism 42.

As was mentioned above, a drive mechanism 42 is provided for the purpose of converting rotary motion of the motor 41 to counterreciprocating motion of the blades 22 and 23. This drive mechanism includes a molded one-piece assembly 108 comprising the gear portion 108a and a pair of eccentrics 108b and 108c (FIGS. 4 and 5). The eccentrics are molded on the end faces of the gear 108a, which is a gear designed to suitably mesh with the worm 75, described above. Preferably, a shaft 109 is molded into the assembly 108 with the ends thereof projecting beyond the ends of the eccentrics 108b and 108c. These eccentrics are adapted to be received within suitable openings 107a (FIG. 5) defined in associated identical connecting rods 110. These connecting rods are preferably also molded from a suitable plastic and are provided at their opposite ends with openings 107b.

To hold the connecting rods 110 in assembled relationship with the assembly 108 and shaft 109a, suitable steel journal 111 is pressed onto each end of the shaft 109, as clearly shown in FIG. 5 of the drawings. The steel journals 111 maintain the molded gear and eccentric assembly 108, the shaft 109 and connecting rods 110 as a suitable subassembly comprising the drive mechanism 42.

For the purpose of supporting the drive mechanism 42 within the base member 36 so that the gear 108a is in driving relationship with the worm 75, the base member 36 is provided with a pair of opposed integral post members 36p (FIGS. 2, 4, 5 and 7). The top of these posts 36p are provided with opposed semicylindrical recesses 113 for supporting suitable annular bearings 114 accommodating steel journals 111. If desired, the semicylindrical recesses 113 are provided with suitable lubrication storing

means (not shown) for lubricating the drive mechanism 42. Preferably, the bearings 114 and recesses 113 are provided with cooperating parts to prevent rotation of the bearings relative to these semicylindrical recesses. In order to hold the bearings 114 within the recesses 113 and, hence, hold the associated parts of the drive means or mechanism 42 in position, the front bearing retainer 59 is provided with a pair of projecting fingers 59b which extend forwardly and engage the top of the annular bearings 114. So that the connecting rods 110 do not interfere with the worm gear 75, the top edges adjacent gear 108 are effectively cut away to define angularly disposed surfaces 110a, as shown in FIG. 2 of the drawings. Since these connecting rods are preferably identical, they obviously will have these angularly disposed surfaces 110a both top and bottom.

From the above description, it will be appreciated that by using a molded gear, molded eccentrics and molded connecting rods a very lightweight construction is provided. Moreover, by using such lightweight construction, high speed cutting action is possible since the mass to be moved is relatively light. In a device built in accordance with the present invention, the motor 41 and the drive mechanism 42 combine to produce an output speed of the blades 22 and 23 of the order of two thousand cycles per minute.

For the purpose of keeping down the weight, improving the balance and further insuring maximum cutting efficiency, the blade holders 43 are also formed of a molded plastic. Since these blade holders are illustrated as being identical, only one will be described in detail, although the same reference characters will be applied to both. In order to be drivably connected to the associated connecting rod 110, the rear end of each blade holder is provided with a molded integral projecting pin 43a (FIGS. 5, 6, 8 and 10) receivable in the opening 107b in the end of the connecting rod 110. Each blade holder 43 is provided with wall portions defining a rectangular chamber 117 open at one side and one end. Each chamber 117 has a width such as to snugly receive the tank portion 22b or 23b of the associated blade 22 or 23, respectively, in a manner to rigidly relate the blade with the blade holder when assembled therewith, as indicated in FIG. 4 of the drawings. The walls defining the chamber 117, just described, are open on the inside face of the blade holder; in other words, the adjacent faces of the two blade holders 43 are open. Of course, the tank receiving end of the blade holder is also open. In order that the tanks 22b or 23b may not slip out of the open sides of the blade holders 43, each blade holder is provided on the inside edge of chamber 117 with a plurality of integral tabs or projections 43b, 43c and 43d, which are adapted to engage the adjacent inside face of the tank 22b or 23b of the associated blade. These tabs or projections 43b, 43c and 43d effectively define a very small portion of the inside wall of chamber 117. In addition, the tab or projection 43d also aids in holding in place a suitable blade ejector spring 118 (FIGS. 4, 6, 8 and 9). An additional tab 43e is provided above the tab 43d, as best shown in FIGS. 6 and 8 of the drawings, to hold this ejector spring in place. Each ejector spring 118 is illustrated as of somewhat L-shaped construction, and one leg of the L is of U-shaped spring material engageable by the end of the tank 22b or 22c so as to provide a sort of resilient cushion when the blade is inserted into its associated blade holder 43 and also to provide an ejection force when the latching means, described hereinafter, are released.

For the purpose of releasably latching the blades 22 or 23 to their associated blade holders 43 and particularly to engage the latching detents 22c or 23c thereof, each blade holder is provided with a blade holding spring 120. Each blade holding spring is provided with a tank portion 120a which is adapted to be disposed in recess 121 defined in the outside face of each blade holder 43, and suitable rivets 122 hold the tank portion 120a of the spring in the recess 121 and secure the blade holding

spring to its associated holder 43. The major portion of each blade holding spring 120 (all except tank portion 120a) extends into the associated chamber 117. The forward portion of each blade holding spring 120 is provided with a diverging tab 120b which is engageable with the end of the tang of the associated blade 22 or 23 so as to deflect the blade holding spring during a blade inserting operation to permit the insertion of the tang of the blade into its holder 43. So that such deflection can occur, the holder 43 is provided with a suitable opening 123 adjacent each diverging tab 120b so that the tab may extend through the opening when the springs are deflected upon insertion of the blade tang into its blade receiving recess 117. To perform its latching function, each blade holding spring 120 is provided with a somewhat elongated latching recess 125 for receiving the associated blade detent 22c or 23c, as best shown in FIG. 5 of the drawings.

For the purpose of releasing each latch spring 120 from its associated blade and particularly for moving the free end of the spring containing opening 125 away from the latching detent 22c or 23c as the case may be, in the manner best shown in FIG. 10 of the drawings, each latch spring is provided with a release projection 120c which is preferably cut from an integral portion of the spring 120 (FIGS. 5, 6, 8, 9 and 10) and projects laterally therefrom so as to extend through a suitable opening 127 defined in the outside wall of each blade holder 43. It will be appreciated that the inherent resilience of the blade holding spring 120 causes the free end of the spring to be deflected a substantial distance into the chamber 117 when the tangs of the associated knife blades 22 or 23 are inserted. Thereafter the spring is returned to the position best shown in FIG. 5 of the drawings to effect latching engagement with detents 22c and 23c. If, now, a force is applied to the free end of each release projection 120c, as indicated in FIG. 10 of the drawings, the junction of the projection 120c with the main portion of the ejector spring 120 becomes a fulcrum engaging the adjacent surface of the blade tanks about which the free end of the blade holding spring pivots. Thus, there is provided a very simple latch means, and the entire blade holder, aside from the rivets, comprises merely the molded holder 43, the blade spring 120 and the ejector spring 118.

In order that the user of the electric knife 20 may readily release the blades 22 and 23 from the associated blade holders 43 by means extending outside the casing of power unit 21, there are provided a pair of blade release buttons 128 preferably molded from a suitable plastic (FIGS. 1, 2, 5, 9 and 10). These buttons are preferably received in a suitable recess 129 defined in the upper casing section 37 adjacent the front of the knife whereby the operator may readily engage both buttons, one on each side, and squeeze them or pinch them together, as shown by the arrows in FIG. 10 of the drawings, to release the blade latching means. The buttons 128 are preferably molded of a suitable plastic. For appearance purposes they may be molded of a material having a different color from the casing and may, for example, have the same color as the trigger switch 97, described above.

For the purpose of biasing the blade release buttons 128 to the normal nonreleased position, there is provided a U-shaped biasing spring 130 (FIGS. 2, 4, 5, 8, 9 and 10). As illustrated, the upper cover section 37 is provided with a pair of integral spaced wall portions 37a depending from the top wall thereof and a pair of integral spaced wall portions 37b extending inwardly from the sides thereof to define recesses for accommodating the bight portion and leg portions of the U-shaped spring 130, as best shown in FIGS. 8 and 9 of the drawings. The ends of the legs of the U defining the spring 130 are provided with laterally projecting tabs 130a receivable in suitable recesses 131 defined in the blade release buttons 128. The inherent resilience of the U-shaped spring thus biases

the buttons 128 apart, as best shown in FIG. 9 of the drawings.

To limit the outward movement of buttons 128 under the bias of spring 130 and to guide reciprocal movement thereof in recesses 129 in the cover 37, cover 37 is provided on each side with a pair of spaced parallel inwardly directed projections 37c (FIGS. 4, 5 and 8), and each release button 128 is provided with projecting ears 128a which extend between projections 37c and overlie shoulders defined on each side of each recess 129 between the projections 37c and the edges of each recess 129, as clearly shown in FIG. 5 of the drawings. So that the release buttons 128 may not be accidentally actuated by engagement with some surface, the upper casing section is provided with ears or projections 37d and the lower casing section is provided with projections 36g between which these blade release buttons 128 project (FIGS. 1, 2, 5, 7, 9 and 11).

For the purpose of guiding the reciprocal movement of the blade holders 43, there are provided a pair of identical blade holder guides 132, best shown in FIG. 6 of the drawings. Each of the blade holder guides includes a holding portion designated at 132a in the form of a rectangular ring molded of a suitable plastic and having opposed guide projections 132b and 132c extending from the center of the inside of the top and bottom walls thereof, respectively, which projections are effectively dividers for separating and guiding the inside edges of the two adjacent blade holders 43, as described in more detail hereinafter. Each blade holder 132 is also provided on the lower surface with a projecting tab 132d, and when mounted in the electric knife 120, the free ends of the projecting tabs 132d of the two blade holders 132 engage each other, thus determining the position of the guides in the assembly, as best shown in FIGS. 4 and 8 of the drawings.

In order that these blade holder guides 132 be supported in the casing, each of the guides is provided on the side of ring 132a from which tab 132d projects with opposed depending projections 132a defining a dovetail groove 134, as best shown in FIG. 6 of the drawings. The upper outside edges of the walls defining the downwardly directed recess 93 are provided with a pair of triangular extensions 36r, and the upper outside edges of the walls defining the upwardly directed recess are similarly provided with a pair of triangular extensions 36s, best shown in FIGS. 7 and 9 of the drawings. When the blade holders 43 are assembled with the drive mechanism 42 in the base 36, then the blade holder guides 132 are moved into position, the rear guide being moved in first with the tab 132d projecting forwardly to receive in the dovetail groove 134 thereof the triangular extensions 36s. Then, the forward blade guide 132 is applied with the tab 132d directed rearwardly and with the triangular extensions 36r received in the dovetail groove 134 of the front guide 132. Suitable spring steel inserts 137 are then inserted between the triangular extensions and the walls defining the dovetail grooves 134 of both guides 132, as best shown in FIGS. 6 and 9 of the drawings, to rigidly hold the guide members in firm guiding position.

So that guide projections 132b and 132c perform a proper guiding function, the adjacent faces of the blade holders 43 are provided with shallow edge recesses at the top and bottom to accommodate these guiding projections therein, as best shown in FIG. 9 of the drawings. Thus, the counterreciprocating motion of the blade holders 43 is properly guided with a minimum of friction between the moving blade holders 43. The blade holder guides 132 are preferably molded from a suitable plastic such as nylon which has a very low coefficient of friction.

In order to make sure that the end of the casing of power unit 21 is closed except for the necessary opening to receive the blade tangs, casing section 37 is pref-

erably provided at the forward end with a transversely extending flange or hilt 37f (FIGS. 1, 4 and 8) which extends downwardly below the base member 36 and provides a projecting support depending below the trigger switch 97 to hide the fastening means 99. The fastening means 39 extend through this projection or hilt 37f into suitable tapped openings in the base member 36. Similarly, the fastening means 39 at the rear of the unit 21 extend into tapped openings defined in suitable posts 37g integrally formed with the upper casing section, as best shown in FIG. 4 of the drawings.

In view of the detailed description included above, the operation of the electric knife of the present invention will readily be understood by those skilled in the art. It will be apparent that a very compact, light-weight, well-balanced construction has been provided which provides very fast cutting action. By virtue of the safety lock described above, the trigger switch 97 cannot be actuated accidentally and, therefore, there has been eliminated the hazard of inadvertently energizing the motor 41 while inserting or removing the blades. This makes the knife substantially safer, particularly in homes with children. By virtue of the push button type of blade release buttons 128, the blades 22 and 23 may be removed without touching the cutting surfaces. In providing the sharp edge and point on the tip of the blades 22 and 23, the user is permitted to cut and trim around bones, which is a very desirable feature from the standpoint of using the electric knife for carving meats and the like. By virtue of the juice guard, all juices are prevented from entering and collecting in the power unit 21. The juice guards, moreover, aid in the removal of the blades which are the only parts of the blades that are engaged after the blade release buttons 128 have been depressed.

While there has been illustrated and described a particular embodiment of the present invention, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the invention in its broader aspects, and it is, therefore, contemplated in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An electrically operated slicing knife comprising a housing, an electric motor mounted in said housing, means for converting rotary motion of said motor to reciprocating motion comprising a pair of blade holders connected to said last mentioned means for opposite reciprocating motion with respect to one another in response to rotation of said motor, guide means for guiding movement of said blade holders, a pair of blade members having adjacent faces in sliding engagement with one another, each of said blade members comprising a cutting portion and a tang portion, means on each of said blade holders defining a rectangular chamber for snugly received therein the tang portion of the associated blade, detent means defined on each tang portion, a pair of resilient members one for each of said blade holders, one end of each resilient member being secured to its associated blade holder, means on the other end of each of said resilient members for engaging the detent means on the tang portion of the associated blade to releasably secure each blade to its blade holder, and means on an intermediate portion of each said resilient member constructed to serve as a fulcrum when a releasing force is applied to each of said resilient members.

2. The slicing knife of claim 1 wherein said guide means comprise ring means enclosing said blade holders.

3. The slicing knife of claim 1 wherein each of said resilient means includes a button actuated extension which when moved toward the associated resilient means causes said other end to move out of engagement with the detent means on the associated blade.

4. A power-operated knife comprising a casing having

an open end, an electric motor within said casing, drive means within said casing and connected to said electric motor, elongated cutting means extending outwardly from the open end of said casing and including a tang portion connected to said drive means within said casing, said drive means reciprocating said cutting means in the direction of the longitudinal axes of said elongated cutting means when said electric motor is energized, said elongated cutting means comprising a pair of counter-reciprocating blades having adjacent faces movable in intimate sliding contact with each other, and a guard secured to each of said blades adjacent said tang portion, each guard comprising a narrow strip extending across the inside face of each blade to prevent grease or other foreign matter from moving onto said tang portion.

5 The knife of claim 4 wherein a diagonal slit is provided at the lower end of each narrow strip to provide an escape path for said grease or other foreign matter.

6 The knife of claim 4 wherein each guard includes a finger engaging portion grasping the associated blade.

7 An electrically operated slicing knife comprising a casing, means defining an opening at one end of said casing, an electric motor mounted within said casing, means for connecting said motor to a source of electrical energy, a pair of driven blade holders within said casing connected to said motor to be driven thereby with a counter-reciprocating motion, a pair of knife blades each having a cutting portion and a tang portion, each of said tang portions being insertable into said opening for engagement with an associated blade holder, a pair of resilient latches, each of said latches being secured to an associated one of said blade holders, each of said resilient latches including a latching aperture, detent means on each blade engageable with the aperture of an associated latch, and release means on each of said latches extending outwardly from said blade holders within said casing, and a release button for each latch, said release buttons projecting outwardly from opposite sides of said casing and causing release of said latches from said detent means when a squeezing force is applied to both release buttons moving them towards one another.

8 The slicing knife of claim 7 wherein said casing is provided with projections adjacent said release buttons to prevent inadvertent actuation thereof.

9 The slicing knife of claim 7 wherein spring means are provided normally to bias said release buttons out of engagement with said latch means.

10 The slicing knife of claim 9 wherein said spring means comprise a U-shaped spring member disposed in a channel defined in said casing.

11 A power-operated slicing knife comprising a hollow knife handle defining a hollow casing, an electric motor in said casing means for connecting said motor to a source of electric energy, rotatable driven means within said casing in driving engagement with said motor, a pair of eccentrics driven by said driven means, a connecting rod connected to each eccentric whereby rotation of said motor causes counterreciprocating movement of said connecting rods, a pair of identical blade holders molded from a suitable plastic including a pin projecting laterally therefrom for engagement with an associated one of said connecting rods, a plurality of guide means each including a ring portion surrounding said blade holders, and a pair of knife blades each being securable to an associated one of said blade holders.

12 The slicing knife of claim 1 wherein a pair of blade release buttons are mounted in said handle, said buttons being movable towards each other to release said knife blades from said holders,

13. The slicing knife of claim 11 wherein said electric motor and said eccentrics are each provided with bearings supported in said casing, and a single clamp means for securing one motor bearing and said eccentric bearings in position in said casing.

14. An electrically operated slicing knife comprising a casing open at one end and of a size which may readily be gripped by the hand of a user, an electric motor positioned within said casing, a driven mechanism in said casing adjacent said open end and drivingly connected to said motor, a knife blade projecting from said open end of said casing and releasably connected to said driven mechanism, a switch positioned within said casing for controlling energization of said motor, a movable hand actuated trigger member having one end pivoted to said casing adjacent said open end and projecting from the underside of said casing for actuating said switch, said casing including projections on the underside thereof, and latch means including a cylindrical projection secured to the other end of said trigger by a thin integral flexible section, said latch means being engageable with said projections for locking said trigger in a position where it is incapable of closing said switch.

15. An electrically operated slicing knife comprising a casing open at one end and of a size which may readily be gripped by the hand of a user, an electric motor positioned within said casing, a driven mechanism in said casing adjacent said open end and drivingly connected to said motor, a knife blade projecting from said open end of said casing and releasably connected to said driven mechanism, a switch positioned within said casing for controlling energization of said motor, a movable hand actuated trigger member having one end pivoted to said casing adjacent said open end and projecting from the underside of said casing for actuating said switch, said casing including projections on the underside thereof, and latch means including a locking portion engageable with said projections for locking said trigger in a position where it is incapable of closing said switch, said locking portion being pivotally connected to the other end of said trigger permitting said portion to be moved between an unlatched position extending radially with respect to the trigger pivot and a latched position displaced from said radial position.

16. A power-operated slicing knife comprising a handle defining a hollow casing, an electric motor, pins projecting from said motor, posts in said hollow casing integral with said handle, recesses in the top of said posts for receiving said pins, wire clamp means within said casing for holding said pins in said recesses, means for connecting said motor to a source of electric energy, rotatable driven means within said casing in driving engagement with said motor, a pair of eccentrics driven by said driven means, a connecting rod connected to each eccentric whereby rotation of said motor causes counterreciprocating movement of said connecting rods, a pair of blade holders each connected to an associated one of said connecting rods, and a pair of knife blades each being securable to an associated one of said blade holders.

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