Aug. 29, 1967 M. S. ROSEN 3,337,952

KNIFE WITH RECIPROCATING BLADES

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FIG. 1

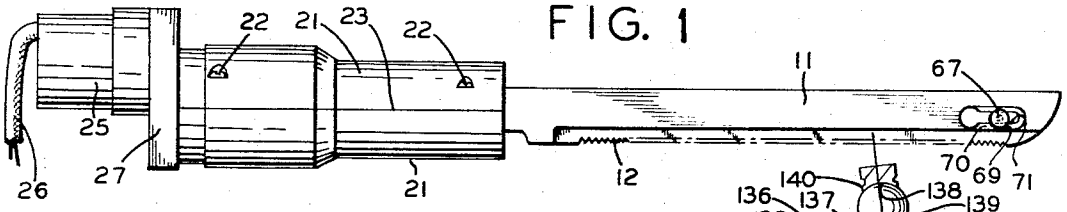


FIG. 15

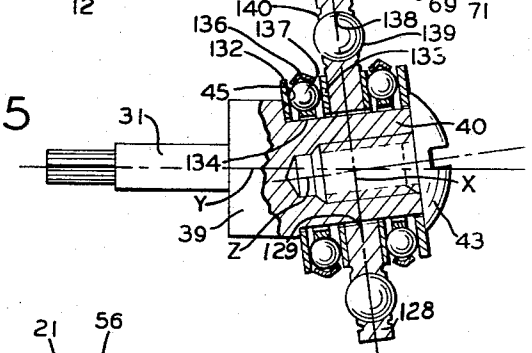


FIG. 2

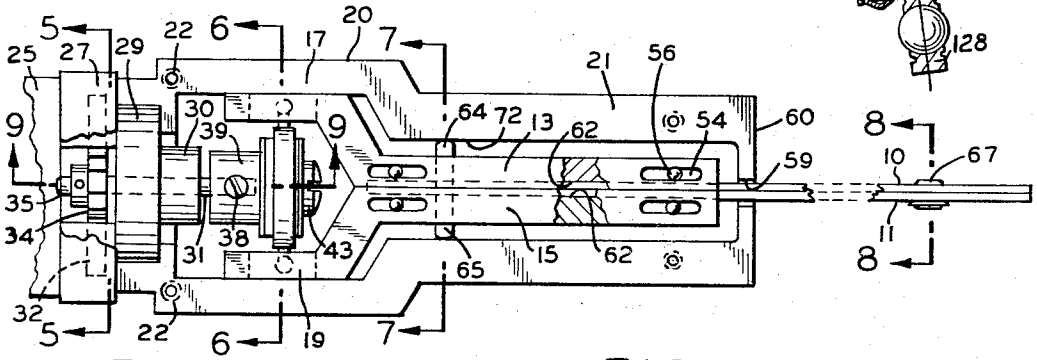


FIG. 3

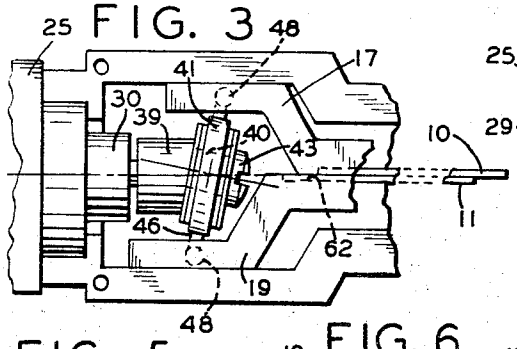


FIG. 4

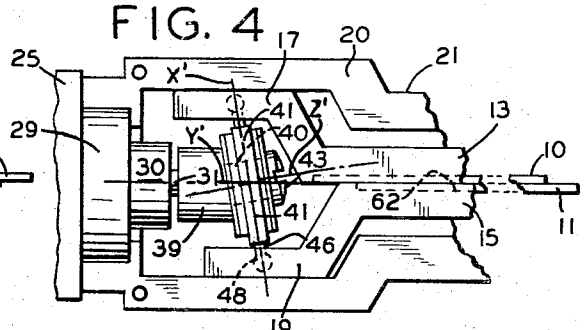


FIG. 5

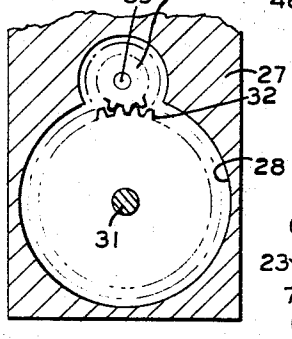


FIG. 6

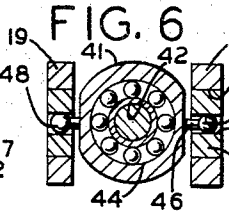


FIG. 8

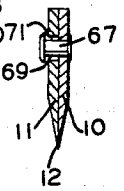


FIG. 7

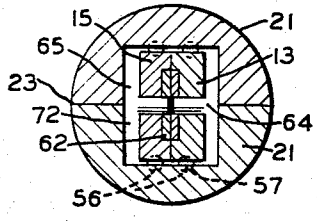
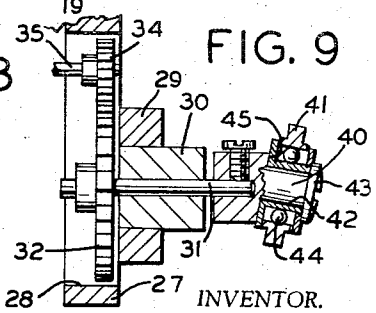


FIG. 9



INVENTOR.
MEL S. ROSEN
BY
JOHN P. CHANDLER
HIS ATTORNEY.

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FIG. 10

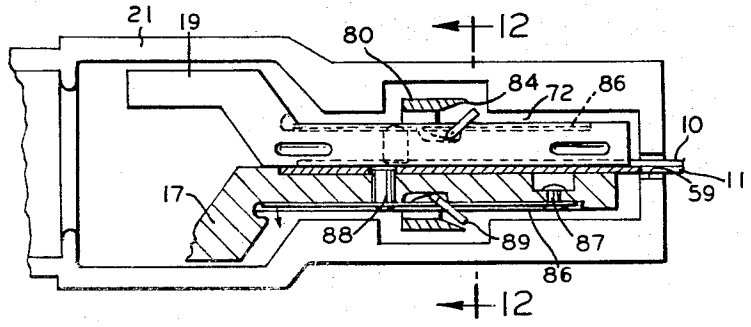


FIG. 11

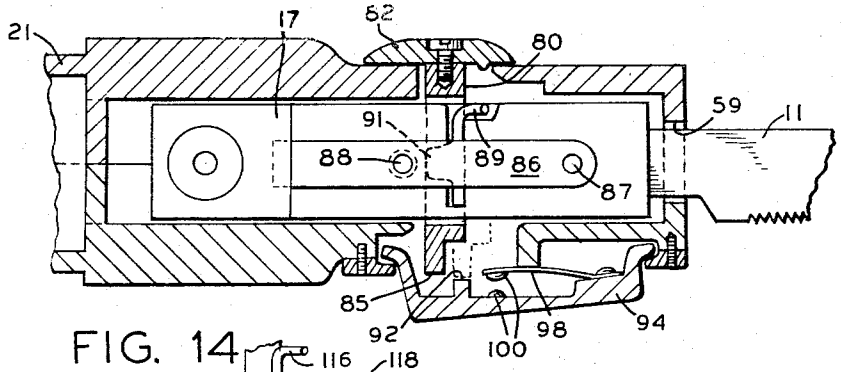


FIG. 14

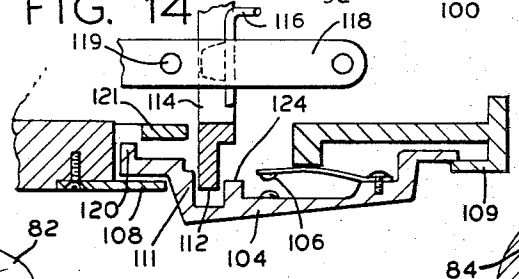
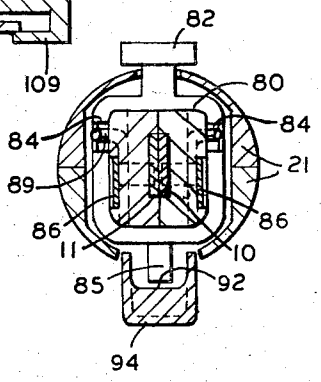


FIG. 12



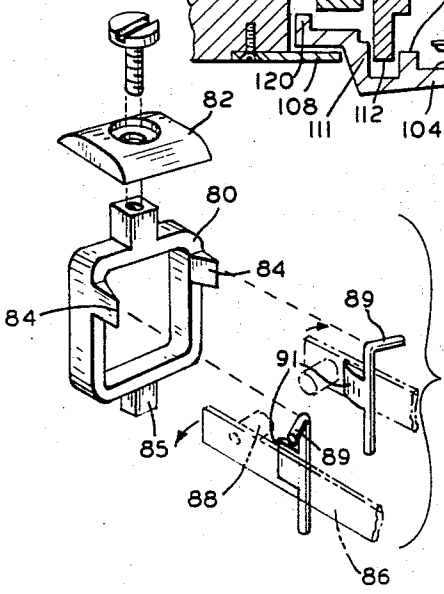


FIG. 13

INVENTOR.
MEL S. ROSEN

BY
JOHN P. CHANDLER
HIS ATTORNEY.

United States Patent Office 3,337,952 Patented Aug. 29, 1967

3,337,952

KNIFE WITH RECIPROCATING BLADES

Mel S. Rosen, 148—44 61st Road,
Flushing, N.Y. 11367

Filed Sept. 7, 1966, Ser. No. 584,296
5 Claims. (Cl. 30—272)

ABSTRACT OF THE DISCLOSURE

A drive mechanism for a motor driven slicing knife having a main drive shaft and an oblique shaft extending from an end thereof with drive means on the oblique shaft connected with the blades in a wobble plate arrangement with anti-friction bearings on both sides of the wobble plate.

This application is a continuation-in-part of my copending application, Ser. No. 392,885, now abandoned.

This invention relates to most cutting devices having motor driven, reciprocating blades and relates more particularly to an improved knife of this character having a pair of oppositely moveable oscillating blades and novel means for converting rotary movement of a motor shaft to such oppositely disposed, oscillating movement.

One embodiment of the invention is a carving knife with two thin serrated blades in side-by-side relation but it will be apparent that other types of cutters, such as saws, may be constructed in accordance with the invention.

An important object of the invention is to provide a small but powerful cutting tool with a pair of blades in side-by-side engagement and reciprocable in opposite directions so as to provide a fast cutting action.

Another object of the invention is to provide a simple transmission mechanism for knives, saws and the like where all moving parts except the actual cutting elements themselves are well protected providing against possible injury to the user.

Yet another object of the invention is to provide an improved anti-friction driving arrangement employing a wobble plate, and wherein this plate is secured for relative rotation on an oblique terminal shaft and has ball bearing assemblies on each side thereof. In other words, the ball bearing assemblies and driving plate are, as it were, sandwiched between two shoulders and in order to prevent any waste motion the ball bearing assemblies and the driving plate are closely fitted but are not under any pre-load compression.

In the drawings:

FIG. 1 is a side elevation of a carving knife embodying the present invention;

FIG. 2 is a plan view of the knife with the top housing section removed;

FIG. 3 is a broken view similar to FIG. 2 but showing the oscillating drive in a different position;

FIG. 4 shows the same structure in another position;

FIG. 5 is a section taken on line 5—5 of FIG. 2;

FIG. 6 is a section taken on line 6—6 of FIG. 2;

FIG. 7 is a section taken on line 7—7 of FIG. 2;

FIG. 8 is a section taken on line 8—8 of FIG. 2;

FIG. 9 is a section taken on line 9—9 of FIG. 2;

FIG. 10 is a broken section showing the knife release;

FIG. 11 is a section taken at right angles to FIG. 10;

FIG. 12 is a section taken on line 12—12 of FIG. 10;

FIG. 13 is an exploded view of the slide assembly;

FIG. 14 is a modified slide arrangement operated by the trigger switch; and

FIG. 15 shows a modified drive for the blades.

A pair of blades 10 and 11 having serrated or toothed edges 12 are mounted for oppositely moving reciprocating motion. The teeth will have a contour best suited for the material which is to be cut. Connecting rods 13 and 15 receive the inner ends of the blades and are of identical contour except that one has a section 17 offset to the right, when viewed from the right hand side of FIG. 2, and the other has a section 19 offset to the left. These connecting rods are journalled for reciprocating linear travel in a two part elongated cylindrical housing, which may form the handles for the cutter, each part being of identical contour and having a section 20 and a reduced shank section 21, the two sections having a seam line 23 when assembled. The two housing sections are secured together by screws 22.

A motor (not shown) is enclosed in a cylindrical housing 25 which is secured to a block 27 having on one side thereof a bearing support 29 which may be formed integrally therewith and supporting in fixed relation, a bearing 30 for a shaft 31 having a gear 32, fast thereon, which in turn is driven by a pinion 34 fast on a motor shaft 35. Block 27 has a cavity 28 for gear 32 and pinion 34.

Driven shaft 31 is secured, by means of a set screw 38, in a central bore in a driving head 39 which has a terminal shaft section 40, whose axis is disposed at an oblique angle to the axis of the driving head. An oscillatory drive fitting or plate 41 has a bore 42 which receives shaft 40 with an anti-friction bearing 44 between the shaft and the oscillatory drive fitting (FIG. 9). The plate is secured on the shaft by means of a screw 43 and is freely rotatable thereon. The inner end of the shaft has a thrust bearing surface 45 and the screw 43 limits opposite thrust of the bearing-plate assembly.

Studs 46 having spherical heads 48 extend laterally from each flat side of plate 41 and each of these heads is disposed in an opening or socket 50 in a block 51. There is one of these sockets for each blade and it is force fitted in a hole 52 in the offset connecting rod sections 17 and 19. The plate which is restrained against rotation during rotation of the oblique shaft has a compound motion, the only portion of which is utilized is that which is necessary to produce the oppositely disposed linear oscillating motion of the connecting rods and the blades they carry.

The upper and lower faces of the connecting rods have longitudinal recesses 54 which receive anti-friction balls 56. The housing sections have mating recesses 57 and the two sets of recesses form linear races for the balls.

The blades 10 and 11 pass through mating openings 59 in the forward wall 60 of shank sections 21 and are received at their inner ends in recesses 62 in connecting rods 13 and 15, said recesses having the same cross-sectional contours as the blades. The blades are made to move with the connecting rods by means of pins 64 and 65. At their outer ends, the blades are retained in face-to-face relation during reciprocation by a pin 67 secured to blade 10 aid which supports a washer 69 which engages bevelled edges 70 of a slot 71 in blade 11. FIG. 7 shows the outer ends of the pins as being confined by the inner walls 72 of the housing cavity. If it is desired to provide for easy removal of the blades and deactivation of the motor when so removed, the structure shown in FIGS. 10–13 may be used. A slide 80 within the cavity 72 in the housing is operated by a finger piece 82 and it has opposed cams 84 and a finger 85 at the bottom.

The connecting rods have on their opposed outer faces, flat springs 86 to which the pins 88 corresponding to pins 64 and 65 are secured. These springs are secured to the connecting rods by rivets 87. When the slide is moved forwardly, i.e., to the right of FIG. 11, the cams

84 contact cranks 89 and a cam portion 91 moves the spring and the pin it is secured to outwardly, freeing the blades. This movement of the slide also causes finger 85 on its lower end to underlie a switch portion 92 so that a trigger member forming a switch 94 for starting the motor cannot be closed. This switch is mounted in a floating manner on the housing wall and is held open by a spring 98 which carries one of two contacts 100.

In the modification of FIG. 14, the external finger piece 82 on top of the housing is eliminated and the trigger 104 carrying the switch 106 is depressible when the parts are in the position of FIG. 14 to close the circuit and is also forwardly movable in a two piece support 108–109. When this trigger is moved forwardly, section 111 contacts a finger 112 carried by the internal slide 114 and moves the same forwardly and rotates the crank 116 which causes withdrawal of the spring 118 with its pin 119.

When in this forward position, the trigger switch cannot be closed because projection 120 contacts fixed block 121. Another projection 124 moves the slide rearwardly when the blades have been re-positioned and the knife is ready for use.

The motor within housing 25 may be operated by house current through connection with extending wire 26. The motor may also be battery operated in which case the motor housing is large enough to receive the batteries and the cord 26 may have male contacts for the purpose of charging the battery.

It will be understood that the external contour of the housing will depend somewhat upon the specific type of cutter, with oppositely reciprocating blades, is to be designed. For example, a hedge clipper will be of a more rugged construction than the more delicate type of carving knife illustrated in FIG. 1. Also, the hedge trimmer will have a more powerful motor.

In the modification of the thrust bearing arrangement of FIG. 15, the driving head 39 fast on motor shaft 31 has the same oblique terminal shaft 40 and thrust bearing surface 45 formed by the reduced diameter of the terminal shaft, and headed screw 43 as in the first embodiment.

In this modification, the wobble or drive plate 128 does not have a ball bearing assembly interposed between its central opening 129 and the oblique shaft, to take up thrust and axial loads as is shown in FIG. 9 but, instead, there is provided a pair of pure thrust ball bearing assemblies 137 positioned on opposite sides of the drive plate and these bearing assemblies are held in firm contact with the plate. These thrust bearings have side plates 132 and 133 and inner and outer ball retainers 134 and 136 for the balls of the bearing assemblies 137.

Instead of providing the studs 46 with the spherical heads 48 to drive the connecting rods, and hence the blade, as shown in FIG. 6, the plate has openings 138 which receive balls 139 which performs the actual driving function. The ends of the opening 138 are peened over at 140 to retain the balls.

It will be noted that the distance between the thrust bearing surface 45 and the headed screw 43 is such as to hold the thrust bearings 137 firmly against the drive plate so that there is practically no lost motion. It is desirable to reduce this lost motion to as small a factor as possible in order to reduce the noise that would accompany a loose fit between shoulder 45 and screw head 43 even though the cutting potential is not greatly reduced. To the same end, it is desirable to confine motion of the ends of the wobble plate carrying balls 139 to reciprocation in a direction generally parallel with the axis of shaft 31 and driving head 39. This is best accomplished by arranging the parts so that a line X intersecting the centers of balls 139 coincide with the axis Y of shaft 31 and the axis Z of the oblique shaft extension, all as shown by the broken lines in FIG. 15. If, on the other hand the axis Z of oblique extension 40 were to pass

through a point above the intersection of lines X and Y, when viewed as in FIG. 15, a compound motion would be set up, the second component of which would not contribute to the smoothness of the drive for the knife blades. The identical relationship of the axes shown in FIG. 15 is also shown at X', Y' and Z' in FIG. 4.

While there have been described herein what are at present considered preferred embodiments of the invention, it will be obvious to those skilled in the art that many modifications and changes may be made therein without departing from the essence of the invention. It is therefore to be understood that the exemplary embodiments are illustrative and not restrictive of the invention, the scope of which is defined in the appended claims, and that all modifications that come within the meaning and range of equivalency of the claims are intended to be included therein.

What I claim is:

1. In a cutter, the combination of a housing, a pair of thin knife blades with serrated cutting edges in side-by-side relation extending from the housing, an electric motor with a shaft in the housing, and means for converting rotary motion of the shaft into oppositely disposed oscillatory motion in the blades, said means including a pair of connecting rods mounted for limited linear travel in the housing and having sockets therein, pins securing the blades to the rods, a driving head on the motor shaft and having a terminal shaft disposed at an oblique angle to the shaft axis, an oscillatory plate freely rotatable on the shaft and provided with studs having spherical heads extending from opposite sides of the plate, said heads being positioned in the sockets in the rods, an electrical switch for the motor and slidable cam means for retracting the pins to permit removal of the blades, said cam means locking the switch against circuit closing when in blade releasing position.

2. In a cutter, the combination of a housing, a pair of thin cutting blades with serrated cutting edges in side-by-side relation extending from the housing, an electric motor with a shaft in the housing, and means for converting rotary motion of the shaft into oppositely disposed oscillatory motion in the blades, said means including a pair of connecting rods mounted for limited linear travel in the housing and having sockets therein, pins securing the blades to the rods, cam means for disengaging the pins from connecting the rods with the blades, a driving head on the motor shaft and having a terminal shaft disposed at an oblique angle to the shaft axis, a drive plate freely rotatable on the shaft and provided with means connecting opposite sides thereof with the rods to impart straight-line, oppositely disposed oscillatory movement to the rods and the blades, and an electric switch for closing a circuit including the motor, said switch being slidable forwardly to disengage the pins, and stop means contacted by the depressible switch when in a forward position to prevent closing of said circuit.

3. In a cutter the combination of a housing, a pair of thin cutting blades with cutting edges in side-by-side relation extending from the housing, an electric motor with a shaft in the housing, and means for converting rotary motion of the shaft into oppositely disposed oscillatory motion in the blades, said means including a pair of connecting rods mounted for limited linear travel in the housing, each having a socket therein, pins securing the blades to the rods, a driving head fast on the motor shaft and a shaft formed integrally with the motor shaft and disposed at an oblique angle to the axis of the driving head, an annular shoulder formed at the inner end of the oblique shaft forming a cam face normal to the axis of said shaft, a drive plate having a central opening receiving the oblique shaft for free rotation therein, thrust ball bearing assemblies on each side of the plate, means comprising said cam face and a headed screw carried at the outer end of said shaft for securing the bearing assemblies in substantial contact with the drive plate, means

at opposite ends of said plate disposed in said sockets to impart generally straight-line, oppositely disposed, oscillatory movement to the rods and the blades, and an electric switch for closing a circuit including the motor.

4. The structure recited in claim 3 wherein said plate has holes at opposite ends thereof and balls forming the drive means are positioned in said holes.

5. The structure recited in claim 3 wherein the oblique shaft has a lesser diameter than the driving head, thus forming said annular shoulder.

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JAMES L. JONES, JR., *Primary Examiner.*