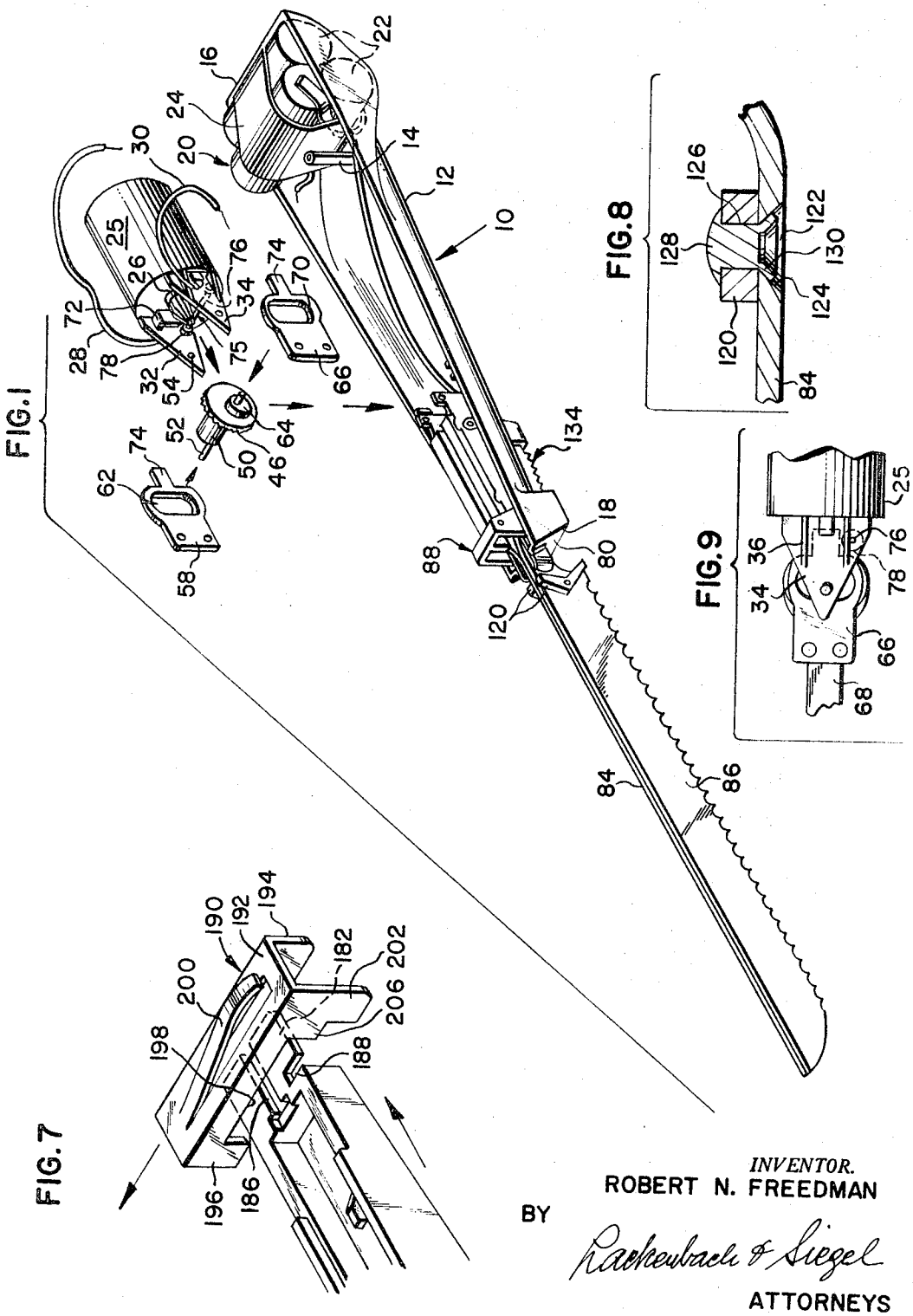
March 14, 1967 R. N. FREEDMAN 3,308,536

CUTTING OR SLICING APPARATUS

Filed Dec. 28, 1965 2 Sheets-Sheet 1



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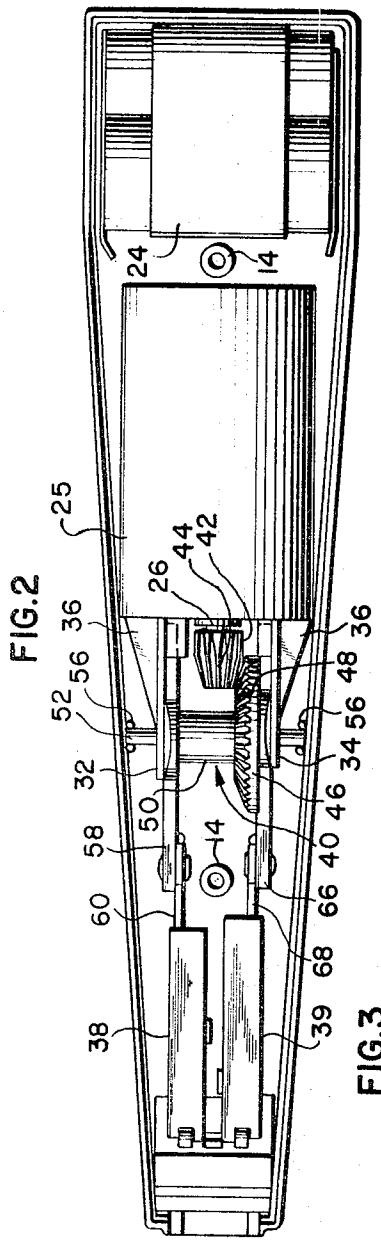
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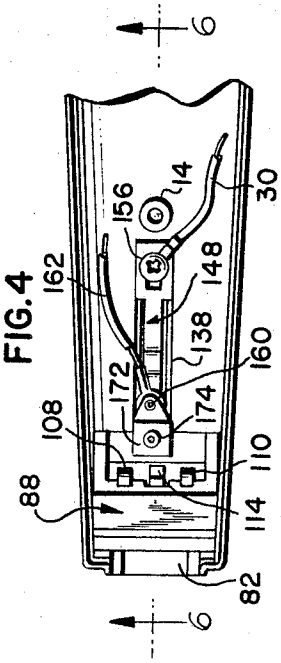
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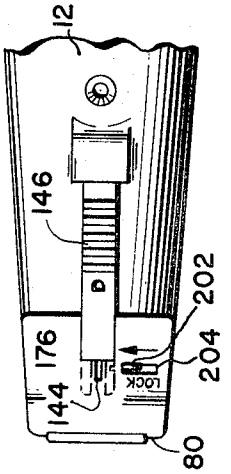
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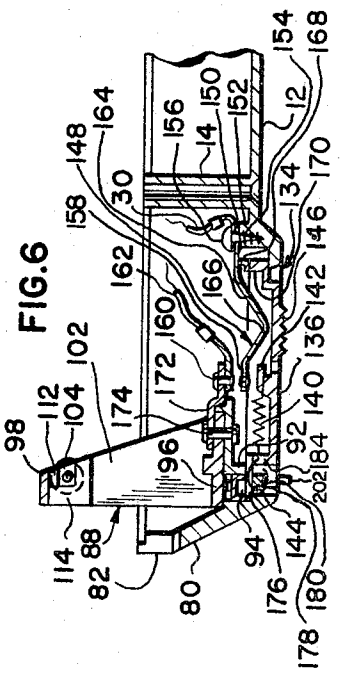
CUTTING OR SLICING APPARATUS

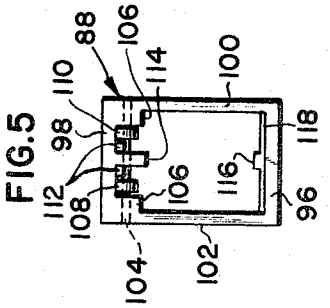
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CUTTING OR SLICING APPARATUS

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6 Claims. (Cl. 30—272)

Statement of the invention

The present invention pertains, generally, to cutting or slicing apparatus, and more particularly, to self-powered portable slicing knives adapted to perform ordinary household culinary chores.

Objects of the invention

Self-powered slicing knives intended primarily for use in the home are presently commercially available. They are, however, subject to certain inherent and significant disadvantages, particularly with respect to those that are self-powered.

For example, self-powered knives are not capable of obtaining the same output or mechanical advantage at the location of the reciprocating blades as are slicing devices of this type adapted to be operatively associated with a conventional source of energy. This is true for a number of reasons, among which are the loss of efficiency between the motor and the location of the output at the reciprocating blades, due for example to the tremendous friction developed at the transmission, the number of cells comprising the source of energy, and many other reasons.

Additionally self-powered slicing knives that are presently commercially available and attempt to obtain a sufficient output at the location of the reciprocating blades rely upon a large number of cells that comprise the power source, such as four cells or five cells, resulting in the presentation of a device of this type that is heavy, cumbersome, difficult to handle and maneuver, and is therefore unwieldy and expensive.

Having in mind the foregoing disadvantages, and others that will be considered readily apparent to those skilled in the art, it is therefore a primary object of the present invention to provide portable cutting or slicing apparatus or devices particularly adapted to perform culinary chores that are constructed and arranged to present maximum output at the location of the reciprocating cutting, slicing or severing blades.

Another primary object of this invention, in addition to the foregoing object, is to provide self-powered portable cutting or slicing apparatus or devices particularly adapted to perform culinary chores that are constructed and arranged to provide maximum output at the location of the reciprocating cutting, slicing or severing blades, said output being substantially the equivalent of the output provided by a device or apparatus of this type constructed and arranged to be operatively associated with a conventional source of energy.

Yet another primary object of the present invention, in addition to each of the foregoing objects, is to provide self-powered portable cutting or slicing apparatus particularly adapted to perform culinary chores that are constructed and arranged to substantially reduce the weight of a device or apparatus of this type, thus presenting a self-powered portable cutting or slicing apparatus or device that is easy to handle, readily maneuvered, comfortable to hold and manipulate during use, compact and generally able to be wielded with facility.

A further primary object of this invention, in addition to each of the foregoing objects, is to provide self-powered portable cutting or slicing devices or apparatus particularly adapted to perform culinary chores that are constructed and arranged to present foolproof safety features, enabling the cutting or slicing devices or apparatus of the present invention to be utilized without danger to the user, and without danger to such other individuals as children, young adults, and the like.

The invention resides in the combination, construction, arrangement and disposition of the various component parts and elements incorporated in cutting or slicing apparatus constructed in accordance with the principles of this invention, and more particularly, the cutting or slicing apparatus of the invention, in one embodiment or modification thereof, comprises a housing having a source of electric power disposed therewith; an electric motor within said housing having a rotating shaft extending therefrom; a driving bevelled pinion gear mounted on said rotating shaft, said pinion gear comprising a material having the physical characteristics of powdered metal impregnated with oil; a driven bevelled gear operatively associated with said pinion gear, comprising a material having the physical characteristics of Delrin filled with a material having the physical characteristic of Teflon; said driven gear further comprising eccentrics disposed in 180 degree out-of-phase relationship to each other; said driven gear and said eccentrics being mounted on a shaft in rotating relationship therewith; said shaft comprising a material having the physical characteristics of centerless ground steel; said eccentrics comprising a material having the physical characteristics of Delrin filled with a material having the physical characteristics of Teflon, and rotating in response to rotation of said driven gear; knife blade actuators responsive to rotation of said eccentrics for reciprcating movement relative to one another; said eccentrics being disposed in direct operative relationship with respect to said driven gear and with respect to said knife blade actuators; knife blades operatively associated with said actuators; and load bearing means mounted within the housing forwardly of the driven gear and above the blade actuators, and within the housing to the rear of the driven gear and below the blade actuators.

Other objects and important features of the present invention will be apparent from a study of the specification following taken with the drawings, which together show, illustrate, describe and disclose at least one preferred embodiment or modification of the invention, and what is now considered to be the best mode of practicing the principles thereof. Other embodiments or modifications may be suggested to those having the benefits of the teachings herein, and such other embodiments or modifications are intended to be reserved especially as they fall within the scope and spirit of the subjoined claims.

Description

In the drawings:

FIG. 1 is an exploded isometric view of a self-powered portable cutting or slicing device or apparatus constructed in accordance with the principles of the present invention;

FIG. 2 is a plan view of the device or apparatus illustrated in FIG. 1, with part of a housing removed to show the interior details of construction;

FIG. 3 is a partial bottom plan view of the device or apparatus illustrated in FIGS. 1 and 2;

FIG. 4 is a view similar to FIG. 3, but with the bottom portion of the housing removed to show the interior details of construction at that location;

FIG. 5 is a front elevational view of one of the components of the self-powered portable cutting or slicing device or apparatus of the present invention;

FIG. 6 is a cross-sectional view taken along the line 6—6 of FIG. 4;

FIG. 7 is a partial isometric view of the components comprising a safety feature constructed in accordance with the principles of the present invention;

FIG. 8 is a cross-sectional view illustrating a certain detail of construction in accordance with the principles of this invention; and

FIG. 9 is a partial elevational view illustrating the manner in which certain components of the present invention cooperate with one another to render the self-powered portable cutting or slicing device or apparatus of this invention comfortable and easy to wield, handle and maneuver.

With particular reference now to FIG. 1 of the drawings, there is illustrated therein a self-powered portable cutting or slicing device or apparatus constructed in accordance with the principles of the present invention, and generally designated by the reference character **10**. This device or apparatus, which will hereinafter be referred to as an electric or electrical slicing knife to facilitate an understanding of this invention, comprises a bottom housing portion **12**, and an upper housing portion (not shown) which is of similar shape and configuration, and is constructed and arranged to be complementary thereto. The bottom housing portion comprises upstanding bosses **14** enabling the housing portions to be fixedly secured with one another in any suitable manner, as is considered readily apparent to those skilled in the art. In order to further facilitate an understanding of this invention, there will hereinafter be referred to a housing in general which is not completely shown and illustrated in the drawings, but which, it is to be understood, comprises the bottom housing portion **12** and the aforementioned upper housing portion (not shown).

The housing comprises a rear location **16** and a front location **18**. A source of power or energy **20**, in this case electrical, is positioned at the rear location **16** of the housing, and comprises a plurality, preferably three, energy cells **22** that may be of any suitable and conventional construction, and preferably are the long-lasting type. It is significant to note, at this point, that a self-powered portable cutting or sliving device or apparaus constructed in accordance with this invention need be supplied with no more than three energy cells, such as the cells **22** in order to provide a device of this type which has a power output at the location of the reciprocating blades, hereinafter to be described, that is substantially the equivalent of similar devices that are constructed and arranged to be operatively associated with a conventional source of energy, such as an electrical outlet, from which it receives the current to operate the same. Of course, if desired, the source of energy or power **20** may comprise more than three cells **22**, though it is emphasized that that number will provide more than sufficient energy to provide the necessary and requisite output at the location of the reciprocating blades enabling the latter to perform their function quickly, efficiently, and the like.

The power or energy cells **22** are secured with respect to one another in any suitable manner, and for example, there is provided a band **24** which may be fabricated of any suitable material extending thereabout.

With continued reference to FIG. 1, and with reference now to FIG. 2, the device or apparatus **10** will be seen to further comprise a motor **25** which may be of any suitable and conventional construction, having an output shaft **26**. As is considered readily apparent, the motor **25** is adapted to receive its energy from the power source **20** in any suitable manner, as for example, through the medium of the conductors **28** and **30**.

A plurality of brackets **32** and **34** are fixedly secured to the motor **25** at the front thereof, and extend forwardly towards the front location **18** of the housing. The brackets **32** and **34** may be generally of triangular configuration, and have integral ears **36** extending towards the motor which function as braces to provide rigidity and stability. If desired, and though not shown, the motor **25** may be constructed and arranged to comprise a rear housing portion, and a front cover plate adapted to be fixedly secured thereto in any suitable manner, and the brackets **32** and **34** may be fabricated integrally with this front cover plate.

The power output available at the output shaft **26** of the motor **25** is adapted to be transmitted to a plurality of reciprocating blade-element actuators **38** and **39** through the medium of a transmission generally designated by the reference character **40**. Self-powered cutting or slicing devices that are presently commercially available utilize transmissions that, however, involve approximately a 40% loss in transferring the electrical energy available at the source **20** into mechanical energy, and transmitting that energy to the reciprocating blade-element actuators **38** and **39**. A substantial portion of this loss in available energy is due to the inefficiency of a number of the components or elements comprising presently commercially available devices of this type, one of the most important among them being the transmission. For example, the gearing elements that are presently used frequenly are fabricated of a baklite linen laminate, or nylon. Other materials presently used are for example a hardened steel. These materials have been found to present a very high coefficient of friction which, as is considered readily apparent, is responsible for inefficiency, and therefore, the loss in transmitting available power. Moreover, presently commercially available devices of this type utilize gearing elements that, when fabricated of the foregoing materials, tend to be at least in part responsible for the very high coefficient of friction, and the resulting inefficiency and loss in transmitting the available power. As an example, a conventional helical gear is frequently used.

In this connection, it will be understood that the motor **25** inherently involves a certain loss in transferring the electrical energy available at the source **20** to the mechanical energy available at the output shaft **26**. It is therefore a criteria that the transmission **40** be constructed and arranged to transmit a maximum amount of the available mechanical energy at the output shaft **26** to the reciprocating blade-element actuators **38** and **39**. To this end, the transmission **40** comprises a drive pinion **42** having a plurality of teeth **44** extending about the periphery thereof. The teeth **44** may be of any suitable form, but preferably are bevelled gear teeth that are fabricated in accordance with the coniflex system or process of fabricating gear teeth by Gleason. Therefore, and while not shown, the sides of the trapezoid defining each bevelled gear tooth **44** will be of curvilinear configuration, rather than linear. The driving pinion **42** may therefore hereinafter be referred to as a coniflex bevel drive pinion, the purpose of which is to be described in greater detail. Suffice it to say at present that the coniflex bevel drive pinion **42** tends to reduce friction to a minimum, and eliminates close manufacturing tolerances for the remaining elements of the transmission **40**, thus reducing manufacturing costs. The coniflex bevel drive pinion **42** may be fabricated of any suitable material, but preferably is fabricated of a powdered iron metal that is impregnated with oil.

The transmission **40** comprises, further, a driven gear **46** having gear teeth **48** extending completely about the periphery thereof. The gear teeth **48** may take any suitable form, but like the gear teeth **44**, preferably comprise bevel gear teeth that are also fabricated in accordance with the Gleason coniflex system. The gear **46** may therefore hereinafter be referred to as a coniflex bevel driven gear. The coniflex bevel driven gear **46** may be fabricated of any suitable material, but preferably is fabricated of a material having the characteristics of Delrin that is filled, for example, with Teflon. A hub **50** is non-

rotatably secured to the coniflex bevel driven gear 46, and for example may be fabricated integrally therewith. The hub 50 is eccentrically rotatably mounted upon a shaft 52 that extends through apertures 54 in the brackets 32 and 34. The bottom housing portion 12 is provided with a plurality of seats or wells 56 within which the ends of the shaft 52 are particularly adapted to be seated.

As is now considered readily apparent, the coniflex bevel drive pinion 42 is particularly adapted to transmit the power available at the output shaft 26 to the rotating hub 50 through the medium of the meshing engagement between the bevelled gear teeth 44 and the bevelled gear teeth 48. As pointed out above, the transmission 40 will be responsible for a major portion of any inefficiency in transmitting mechanical energy to the reciprocating blade-element actuators 38 and 39. To this end, the pinion 42 and the gear 46 preferably are bevelled gears with their teeth being fabricated in accordance with the foregoing system or process. In addition, the coniflex bevel drive pinion 42 preferably is fabricated of a powdered iron impregnated with oil, while the coniflex bevel driven gear 46 preferably is fabricated of a material such as Delrin filled, for example, with Teflon. In accordance with this construction, it has been found that the transmission 40 operates at maximum efficiency. The efficiency with which the transmission 40 operates is further enhanced by injecting a grease thereinto, as for example, between the meshing teeth of the pinion 42 and the gear 46. While any suitable grease may be utilized, a Teflon grease or other material having similar characteristics is preferred. A material having the characteristics of a Teflon grease is of heavy consistency, and, since the device or apparatus 10 operates at fairly low speeds, it has been found that this material will last for years, and will stay in place. Moreover, it has been found that such a material tends to migrate into the moving elements or components of the transmission 40. Furthermore, a material such as Teflon grease assists in ironing out the fine points of the gear teeth 44 and 48, so that they tend to lap together slightly.

The hub 50, which is fixedly secured to the coniflex bevel gear 46, is adapted to transfer its rotational movement about the shaft 52 to a reciprocating movement of the reciprocating blade-element actuators 38 and 39. To this end, the actuator 38 comprises a follower 58 fixedly secured thereto in any suitable manner, as through the medium of a connecting link 60. The follower 58 comprises an aperture 62 therein which is of oval configuration in a vertical direction. The hub 50 is particularly adapted to be disposed within the aperture 62, and as is now considered readily apparent will transfer the eccentric rotational movements of the hub 50 into reciprocating movements of the actuator 38.

A second hub 64 is fixedly secured relative to the coniflex bevel gear 46 on an opposite face thereof, and may be fabricated integrally therewith. The hub 50 and the second hub 64 preferably are positioned 180 degrees out of phase with one another since as is also considered readily apparent, the actuators 38 and 39 are adapted to be reciprocated out of phase with one another. The actuator 39, like the actuator 38, comprises a follower 66 fixedly secured thereto in any suitable manner, as through the medium of a connecting link 68. The follower 66 comprises an aperture 70 extending therethrough which is of the same configuration as the aperture 62. The second hub 64 is adapted to be positioned within the aperture 70, and to transfer the eccentric rotational movements thereof relative to the shaft 52 into reciprocating movements of the actuator 39.

The shaft 52 may be fabricated of any suitable material, but preferably is fabricated of a steel or other similar material that is centerless ground. As is considered readily apparent, the shift 52 is not prevented from rotating, but does not tend to rotate due to the pressure created between the shaft and the surface of the ears 32 and 34 surrounding the apertures 54 as the hubs 50 and 64 eccentrically rotate thereabout. However, a centerless ground steel shaft, such as the shaft 52, presents a very highly polished bearing surface. The hubs 50 and 64 may be fabricated of any suitable material, and like the bevel gear 46, preferably are fabricated of a plastic material, such as Delrin, that is filled with a material having characteristics similar to Teflon. Teflon filled Delrin hubs, such as the hubs 50 and 64, in conjunction with the centerless ground steel shaft 52, presents a very low friction bearing surface between these elements. This is particularly true when the bore (not shown) in the hubs 50 and 64 to which the shaft 52 extends is filled with a grease, such as a Teflon grease. It is of course desirable that the materials, namely, a plastic such as Delrin, and a material such as Teflon, be commingled in such a manner as to present a homogeneous mixture of resulting composition from which the hubs 50 and 64 are fabricated. To this end, for example, the hubs 50 and 64 may be fabricated through the medium of any suitable process, such as injection molding techniques. As pointed out above, the hubs may be fabricated integrally with the bevel gear 46 since that element preferably is fabricated of the same material. Accordingly, the hubs and this gear may be injection molded as a single unit.

In accordance with the foregoing construction, and emphasizing that the shaft 52 is preferably a centerless ground steel shaft, that the hubs 50 and 64 preferably are fabricated of Teflon filled Delrin, and that the bore in the hubs through which the shaft 52 extends is preferably filled with Teflon grease, the transmission 40 presents an unusually efficient construction. This is true since the coefficient of friction is maintained at a minimum, friction losses are therefore substantially reduced, and the transmission 40 therefore is unusually efficient in transmitting the power of the output shaft 26 to the reciprocating blade-element actuators 38 and 39. In this connection, it is noted that the hubs 50 and 64 actually comprise both a shaft and an eccentric, and function to transmit the rotational movement of the bevel gear 46 directly to the followers 58. That is, the complex arrangement of parts and elements usually relied upon in devices of this type to transmit rotational movement into reciprocating movement of the actuators 38 and 39 is eliminated. In its stead, the transmission 40 comprises a minimum number of parts comprising a bevel pinion and a bevel gear, and a plurality of eccentric shafts or hubs, the latter being positioned in a 180 degree out of phase relationship with respect to one another, and being rotatably mounted on a shaft that is constructed of a material and in such a manner as to present a very fine bearing surface.

In accordance with the foregoing construction, it has been found that the transmission 40 is capable of transmitting up to 98% of the mechanical energy available at the output shaft 26 to the actuators 38 and 39. It is to be remembered that one aspect, among others, of constructing and arranging a transmission of maximum efficiency is that, as pointed out above, the hubs 50 and 64 act or function as both a shaft and as an eccentric, and that the eccentrics transfer their motion directly to the followers 58 and 66. Another important aspect is to maintain the coefficient of friction as low as possible, and in this connection, it will be noted that the materials from which the hubs 50 and 64 and the followers 58 and 66 are fabricated preferably should be dissimilar materials. Thus, while the followers may be fabricated of any suitable material, preferably they are fabricated of a material having characteristics similar to Delrin. Since the hubs are fabricated of Teflon-filled Delrin, and the followers are fabricated of Delrin, these elements are fabricated of dissimilar materials. In addition, a Teflon grease or other suitable material is injected between these elements. It has been found that this relationship of elements, and

the materials from which they are fabricated, provides a maximum reduction in the coefficient of friction, thus presenting an unusually efficient transmission capable of transmitting up to 98% of the available energy at the output shaft 26 to the actuators 38 and 39.

It is considered readily apparent that an upward force will be directed against the reciprocating blades (hereinafter to be described) of the device or apparatus 10 during use. This upward force will cause the blades and thus the reciprocating blade-element actuators 38 and 39 to pivot about a location disposed at the front 18 of the housing for reasons that will also be set forth more fully hereinafter. The blades, the actuators 38 and 39, the links 60 and 68, and the followers 58 and 66, as units, will therefore tend to pivot in a generally clockwise direction, as viewed in FIG. 1, during use when this upward force is applied to the blade. Once the maximum available energy has been transmitted by the transmission 40 to the followers 58 and 66, it is desirable that every effort be made to insure that the coefficient of friction particularly between all moving parts is maintained, as low as possible, as well as to take-up any applied load. To this end, the brackets 32 and 34 each comprise guide housings 72 which are of L-shaped configuration having a lower open and unobstructed end. The followers 58 and 66 each comprise guides 74 which are particularly adapted to extend into the housing 72. Each housing therefore tends to maintain in alignment the units comprising a follower, a connecting link, an actuator and a blade-element. Since the guide 74 and the housing 72 reciprocate with respect to one another, friction will be developed therebetween. To maintain the coefficient of friction as low as possible, a grease or other suitable lubricating material, such as Teflon grease, is injected therebetween.

The tendency of the followers to pivot about the front location 18 of the housing in view of the upward force applied to the blade elements during use is precluded by a bearing assembly 75 comprising a shaft 76 extending transversely of the motor 25 between the brackets 32 and 34, and being journalled with respect thereto. A plurality of bearing wheels 78 are rotably mounted on the shaft one at each end thereof in vertical alignment with respect to a respective one of the housings 72. The bearing wheels 78 may be held in position on the shaft 76 adjacent the responsive one of the brackets 32 and 34 in any suitable manner, as through the medium of collars (not shown). It will now be understood that the downward pressure of the guides 74 will be taken up by the bearing wheels 78. To maintain the coefficient of friction at an absolute minimum, the bearing wheels preferably are fabricated of a material such as Delrin, though they may be fabricated of any other suitable material. In addition, a suitable lubricant, such as Teflon grease, is injected in-between, about and upon these elements.

The front location 18 of the housing is defined by an end wall 80 having a rectangular channel-like opening 82. The substantially complementary top housing portion (not shown) will comprise a similar opening in an end wall through which a plurality of blade elements 84 and 86 are particularly adapted to extend. The actuators 38 and 39 are, though not shown, of channel-shaped configuration, and are particularly adapted to receive the blade elements 84 and 86. The blade elements are constructed and arranged to be removably connected to a corresponding one of the actuators 38 and 39. This may be accomplished in any suitable manner, and for example, may be accomplished in the manner and by the structure shown, described, disclosed and illustrated in the patent to A. H. Freeman, U.S. Patent No. 3,153,852 the patent to J. W. Beisheim et al, U.S. Patent No. 3,189,998 or the like.

To guide the actuators 38 and 39 and to maintain them in longitudinal alignment, the housing further comprises an upstanding arch generally designated by the reference character 88. The arch is fixedly mounted upon a platform 90 which is fabricated integrally with the bottom housing portion 12, and has a vertical wall 92 spaced from the front location 18 to define a well 94 therebetween.

With particular reference now to FIG. 5, it will be seen that in front elevation the arch 88 is generally of rectangular configuration, and comprises a bottom wall 96, a top wall 98, and a plurality of side walls 100 and 102 which in elevation (see FIG. 6) are of generally trapezoidal configuration. A shaft 104 extends transversely of the arch 88 and is journalled within a plurality of bosses 106 fabricated integrally therewith. A plurality of bearing wheels 108 and 110 are rotably mounted upon the shaft 104. The bearing wheels may be fabricated of a material such as Delrin, or other similar material having substantially the same characteristics. The arch further comprises a plurality of stops or abutments 112 that are fabricated integrally with the arch 88 and extend downwardly from the top wall 98 thereof. The abutments 112 function conjointly with the bosses 106 to retain the bearings or bearing wheels 108 and 110 in their position illustrated in FIG. 5, for example.

The arch 88 further comprises a separator 114 that may be fabricated integrally with the arch, and extends downwardly from the top wall 98 thereof. The separator 114 is generally of L-shaped configuration, as clearly shown in FIG. 6, enabling the shaft 104 to extend transversely of the arch. The arch further comprises a lower separator 116 that extends upwardly from a ridge 118, both of which may be fabricated integrally with the arch 88 at the bottom wall 96. The separators 114 and 116 function conjointly to define guide areas for each of the reciprocating blade-element actuators 38 and 39. Accordingly, the actuators will be retained in longitudinal alignment and any undesirable lateral movement will be substantially, if not completely, eliminated.

As pointed out above, there is an upward force applied to the blade-elements 84 and 86 during use. This force will tend to pivot or rotate the units comprising, respectively, the element 84, actuator 38, link 60 and follower 58; and the element 86, the actuator 39, the link 68 and the follower 66 in a generally clockwise direction as viewed in FIG. 1. Accordingly, the arch 88 becomes the pivot point or pivot location for these units. It will now be understood that this upward force will cause the units to bear against the bearing wheels 108 and 110. The bearing wheels 108 and 110 will herefore act to take-up a portion of the load developed as a result of this upward force applied to the blade-elements during use. Since the actuators bear against these bearings or bearing wheels, they are preferably fabricated of a material such as Delrin, as pointed out above. It has been found that this choice of materials tends to reduce the coefficient of friction between these elements to a minimum. To insure this result, a suitable lubricant, preferably a lubricant such as Teflon grease, may be installed between these elements. It will also be understood, at this point, that another portion of the load will be taken-up by the bearing wheels 78. It has been found that the coefficient of friction at this location, as well, is reduced to a minimum in view of the choice of materials of the elements as well as the lubricant installed therebetween. It is emphasized, therefore, that the construction and arrangement of the transmission 40, the choice of materials of the elements thereof, the specific manner in which they coact with one another, and even the choice of material of the lubricant utilized is responsible for transmitting a maximum percentage of the mechanical energy available at the output shaft 26 to the blade-elements 84 and 86. As hereinbefore pointed out, it has been found that up to 98% of this available mechanical energy is made available at the reciprocating blade-elements. Accordingly, it is only necessary to utilize three of the energy cells 22 in order to present a source of power 20 that

provides a more than adequate amount of available electrical energy.

The reciprocating blade-elements **84** and **86** each comprise a grease guard **120**. The grease guard may be fabricated of any suitable material as, for example, a material such as Delrin. It is considered readily apparent that the inside surfaces of the elements **84** and **86** will be disposed very close to one another during use of the device or apparatus **10**. Accordingly, the entire inside surface of each of the elements **84** and **86** must be as flush as possible to insure efficient operation. In addition, it is considered readily apparent that the method, procedure or technique for fixedly securing the grease guards **120** to the elements **84** and **86** should be chosen with a view towards ease of assembly, economics of assembly, and with a view towards insuring that the guards remain fixedly secured to the blade-elements during the life of the device or apparatus **10**. To this end, each blade-element is provided with an aperture **122** having a bevelled or tapered surface or wall **124** defining the confines or area of the aperture. The grease guards also comprise an aperture **126** the diameter of which is approximately the same as the smallest diameter of the aperture **122** in the blade-element.

The grease guards preferably are fixedly secured to the blade-elements through the medium of a rivet **128**. While this rivet may be of any suitable and conventional form, preferably it is an annealed stainless steel semi-tubular rivet which may be applied by any conventional apparatus, procedure or technique, such as through the medium of an automatic riveting machine. The rivet is applied cold so that when the flanges **130** and **132** are turned outwardly, they will be firmly applied against the bevelled surface **124**, and will remain fixed in this position during the life of the device or apparatus **10**. In this manner, the use of such fasteners as screws is eliminated, as is therefore the need to utilize highly controlled power screwdrivers to avoid stripping the fasteners. Therefore, the grease guards **120** will not be inadvertently dislodged from the blade-elements during the life of the device or apparatus **10**. In addition, the inside surfaces of the blade-elements are perfectly flush, so that no projections, protuberances, or the like exist that will rub against the opposite blade-element during use. This is particularly important since, as is considered readily apparent, any separation of the blades during use will in effect cause, for example, two slices of an edible product to be severed, each being of a different width. This in addition causes sticking, and otherwise decreases the efficiency of the apparatus **10**.

With particular reference now to FIGS. 3, 4, 6 and 7, there is illustrated therein a switch assembly generally designated by the reference character **134**. The switch assembly comprises an actuator **136** of generally rectangular configuration disposed within an aperture **138** of similar shape in the bottom housing portion **12**. The actuator **136** is adapted to reciprocate within the aperture **138**, and in addition is biased to one position through the medium of a biasing element or spring **140**. The actuator **136** comprises a projection **142** about which one end of the spring **140** is secured. The other end of the spring **140** is secured within a slot **144** extending through the bottom housing portion **12** at the front location **18** thereof. The actuator **136** further comprises a serrated portion **146** to facilitate its being gripped and reciprocated within the aperture **138** by the finger of a user's hand.

The switch assembly **134** further comprises a circuit closing or contact element generally designated by the reference character **148**. This element at one end **150** thereof is adapted to be fixedly secured to the bottom housing portion **12**. To this end, the latter comprises a boss **152** having a bore **154** within which a suitable fastener, such as a screw **156**, is particularly adapted to be run home. This one end **150** of the circuit closing element or contact **148** is, as just pointed out, adapted to be affixed to the housing at this location, as through the medium of the fastener **156**, and is therefore adapted to function as one contact in the circuit controlled by the switch assembly **134**, hereinafter to be described. Another end **158** of the circuit closing element **148** is adapted to function as the other contact in this circuit, and is particularly adapted to cooperate with a third and stationary contact **160**. The third and stationary contact **160** may be connected to the source of energy **20** in any suitable manner, as through the medium of a conductor **162**. The source of energy may then be connected to the motor **25** through the medium of the conductor **28**, as pointed out above, which is then connected to the first and stationary contact **156** through the medium of the conductor **30**. The contact **158** at the other end of the circuit closing element **148** must therefore be a movable contact, and to this end, the circuit closing element may be fabricated of a suitable flexible material, such as Phosphor bronze, that tends to be normally retained in the position clearly shown in FIG. 6.

The circuit closing element **148** further comprises an actuating portion **164** of generally triangular configuration, having an apex **166** adapted to bear against the inner surface of the actuator **136** opposite the serrated portion **146** thereof. Additionally, the circuit closing element **148** comprises a stop or projection **168** adapted to bear against an upstanding end wall **170** of the actuator **136** when the latter is disposed in the position to which it is normally biased by the biasing element **140**. Because of this abutting relationship between the abutment **168** and the end wall **170**, a user is precluded from pushing upwardly against the actuator portion **164** of the circuit closing element **148**, the apex **166** being spaced from the actuator **136** in this position of the latter. However, if the user not only pushes upwardly on the actuator **136**, but also causes it to reciprocate rearwardly of the bottom housing portion **12** against the force of the biasing element **140**, the upstanding end wall **170** will move to a position disposed rearwardly of the abutment **168** into a space defined between that element and the boss **152**. This space is of sufficient dimension to enable the end wall **170** to move upwardly thereinto. As a result, the actuator **136** will bear against the actuating portion **164** of the circuit closing element **148**, and cause it to move upwardly against this inherent biasing force. The movable contact **158** will then be moved into engagement with the stationary and third contact **160** to close the circuit to the source of energy **20** in the motor **25**. In connection with the third and stationary contact **160**, this element comprises a bracket **172** fixedly secured to the bottom wall **96** of the arch **88** in any suitable manner, as through the medium of rivet **174**. This rivet **174** also serves the function of fixedly securing the arch **88** relative to the bottom housing portion **12** at the front location **18** thereof.

As hereinbefore pointed out, the platform **90** has a vertical or upstanding portion **92** that defines a well **94** with the front location **18** of the bottom housing portion **12**, that is, with the front wall **80** thereof. The upper limits of this well are defined by the bottom wall **96** of the arch **88**. The lower limits of this well are defined by a bottom wall **176** of the bottom housing **12** which, at the longitudinal center thereof, comprises the slot **144**. The bottom wall **176** is recessed at this location, as indicated by the reference character **178** to provide a ridge **180** about which the other end of the spring **140** is adapted to be disposed. The reciprocating actuator **136** comprises a projection **182** of generally rectangular configuration that extends towards the front location or front wall **80** of the bottom housing portion **12** from an upstanding front or end wall **184** of the actuator. The projection **182** comprises a slot **186** located at the longitudinal center thereof within which that end of the biasing element **140** wrapped around the ledge **180** may be disposed, enabling the actuator **136** to be reciprocated in the manner herein-

before set forth. The projection **182** further comprises a transverse slot **188** for a purpose presently to be described.

As hereinbefore pointed out, it is necessary for an operator or user of the device **10** not only to push upwardly against the actuator **136**, but to cause the same to reciprocate rearwardly of the bottom housing portion **12**. This inherently introduces a safety feature to cause inadvertent actuation of the device or apparatus. A device of this type inherently requires fool-proof construction to avoid the inadvertent actuation thereof, thus preceluding even the slightest possibility of injury. To this end, the switch assembly **134** still further comprises a safety lock assembly which, in addition to the projection **182** of the actuator **136**, comprises a safety lock element generally designated by the reference character **190**. This element may be constructed of any suitable material, and is of channel-like configuration having a top wall **192**, and a plurality of side walls **194** and **196**. Each of the side walls **194** and **196** are recessed, as indicated by the reference character **198**, enabling the safety lock element **190** to be disposed within the well **94** about or on either side of the projection **182**. The top wall **192** is punched-out to provide or present a finger-like element **200** against which the arch **88** is particularly adapted to abut, insuring that the safety lock element **190** will be retained in its position within the well. It is desirable that the finger element **200** inherently present a certain degree of resiliency, and to that end, the material from which the element **190** is fabricated should be chosen accordingly.

The side wall **196** comprises a projection or ear **202** which is adapted to extend through a slot **204** in the bottom wall **176** of the housing portion **12**. Since the side walls **194** and **196** are recessed, the side wall **196** will define a ledge **206** adapted to reciprocate into and out of the slot **188**. It will now be understood, therefore, that when the safety lock element **190** is caused to reciprocate transversely of the bottom housing portion **12** in the direction of the arrow clearly shown in FIG. 3, the ledge **206** will be caused to move into the slot **188**, thus precluding an operator from reciprocating the actuator **136** rearwardly of the housing portion. However, when the safety lock element **190** is caused to reciprocate transversely of the bottom housing portion **12** in an opposite direction, the ledge **206** will be moved out of engagement with the slot **188**, and an operator will be able to move the actuator **136** both rearwardly of the bottom housing portion **12**, and upwardly thereof. In this connection, it is noted that the maximum dimension of the recess **198** in each of the side walls **194** and **196** is chosen accordingly.

In view of this construction, there is provided an absolutely fool-proof switch assembly **134** that cannot be actuated until a positive step is taken to release the safety locks (in this connection, suitable indicia may appear on the bottom wall **176**, as shown in FIG. 3) assembly. Another positive movement is required, in that upward movement of the actuator **136** alone, is not sufficient. Neither is a reciprocal movement of the actuator against the influence of the biasing element **140** rearwardly of the housing portion **12** sufficient. Rather, a combination of these types of movement must be effected before the actuating element **148** will cause the movable contact **158** to engage the stationary contact **160**.

In view of the foregoing, it will now be appreciated that the present invention is capable of achieving each and every one of the objects set forth at the outset of this specification, as well as others that will be apparent to those skilled in the art. A device or apparatus constructed in accordance herewith is capable of providing an output at the blades substantially the same as apparatus of this type to be connected to a conventional outlet, while yet being compact, of light-weight, and easy to manipulate and maneuver during use. This is particularly true since the device is constructed and arranged to be operable under conditions of maximum efficiency, specifically, among other things, with respect to transmitting up to 98% of the mechanical energy available at the output shaft of the motor. In addition, a device or apparatus constructed in accordance herewith is fool-proof from the point of view of safety. This is particularly true since, not only is a positive action required to release the lock, but the actuator of the switch assembly requires not only an upward movement, but a reciprocating movement to the rear of the bottom housing portion as well. Therefore, if the device or apparatus **10** is resting upon a table, fork, plate, or the like, a mere upward force applied to the actuator **136** will not close the circuit, since it is necessary to reciprocate the actuator forwardly as well. Of particular importance, the safety features of the present invention present a deterrent to children or young adults, thus precluding the possibility of danger thereto by way of injury.

While the invention has been shown, illustrated, described and disclosed in terms of embodiments or modifications which it has assumed in practice, the scope of the invention should not be deemed to be limited by the precise embodiments or modifications herein shown, illustrated, described or disclosed, such other embodiments or modifications intended to be reserved especially as they fall within the scope of the claims here appended.

What is claimed is:

1. Portable slicing apparatus comprising, in combination, a housing having a source of electric power disposed therewithin; an electric motor within said housing having a rotating shaft extending therefrom; a driving bevelled pinion gear mounted on said rotating shaft, said pinion gear comprising a material having the physical characteristics of powdered metal impregnated with oil; a driven bevelled gear operatively associated with said pinion gear, comprising a material having the physical characteristics of Delrin filled with a material having the physical characteristics of Teflon; said driven gear further comprising eccentrics disposed in 180 degree out-of-phase relationship to each other; said driven gear and said eccentrics being mounted on a shaft in rotating relationship therewith; said shaft comprising a material having the physical characteristics of centerless ground steel; said eccentrics comprising a material having the physical characteristics of Delrin filled with a material having the physical characteristics of Teflon, and rotating in response to rotation of said driven gear; knife blade actuators responsive to rotation of said eccentrics for reciprocating movement relative to one another; said eccentrics being disposed in direct operative relationship with respect to said driven gear and with respect to said knife blade actuators; knife blades operatively associated with said actuators; and load bearing means mounted within the housing forwardly of the driven gear and above the blade actuators, and within the housing to the rear of the driven gear and below the blade actuators.

2. Portable slicing apparatus as defined in claim **1**, wherein said knife blade actuators each comprise a follower having an aperture within which a respective one of said eccentrics is disposed; said followers comprising a material having the physical characteristics of Delrin.

3. Portable slicing apparatus as defined in claim **1**, wherein there is further provided an arch positioned relative to said housing; and wherein said load bearing means comprises a shaft carried by said arch for defining a pivot location about which said actuators tend to pivot when a force is applied thereto during manipulation of said apparatus; a plurality of rotatable load-bearing wheels mounted upon said shaft for cooperation with a respective one of said actuators; a second shaft positioned relative to said housing in spaced apart relationship to said first mentioned load-bearing shaft; and a plurality of rotatable load-bearing wheels mounted with said last men-

tioned shaft for cooperating with guides extending from a corresponding one of said followers.

4. Portable slicing apparatus as defined in claim **1**, wherein said bevelled pinion and driven gears comprise coniflex form gear teeth.

5. Portable slicing apparatus as defined in claim **1**, wherein said eccentrics and said driven gear are integrally formed with respect to one another.

6. Portable slicing apparatus as defined in claim **1**, wherein there is further provided a lubricant comprising a material having the physical characteristics of Teflon grease disposed between the parts of said apparatus which are disposed in cooperative moving relationship with respect to each other.

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