United States Patent [19]

Marrie

[11] **3,815,226**

[45] **June 11, 1974**

[54] **AUTOMATIC CAN OPENER WITH CAN DISENGAGEMENT THROUGH MOTOR REVERSAL**

[75] Inventor: **Paul Marrie,** Dijon, France

[73] Assignee: **Societe Etud,** Quetigny, France

[22] Filed: **Feb. 14, 1972**

[21] Appl. No.: **225,935**

[30] **Foreign Application Priority Data**

Apr. 7, 1971 France 71.12243

[52] **U.S. Cl.** ..... **30/4 R**

[51] **Int. Cl.** **B67b 7/38**

[58] **Field of Search** ..... 30/4 R, 6.4

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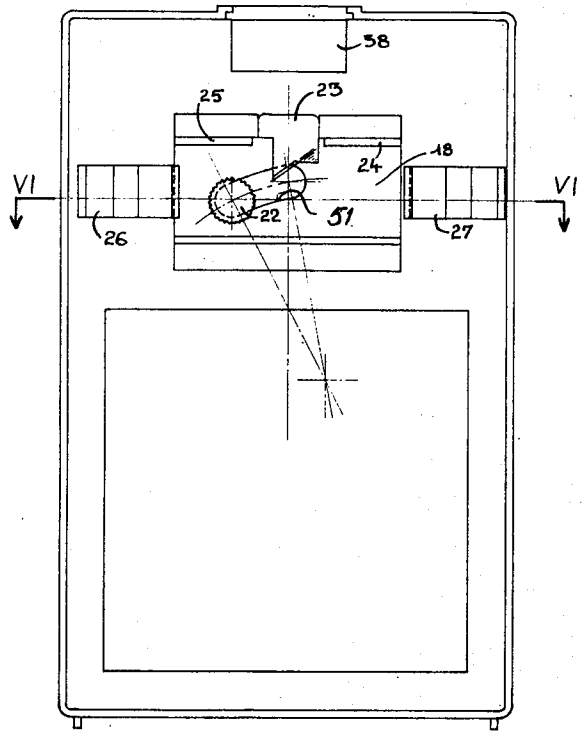
Primary Examiner—Al Lawrence Smith
Assistant Examiner—Gary L. Smith
Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] **ABSTRACT**

Device for automatic opening of cans which includes a swinging arm upon which a rotating knurl is mounted for engaging the can against a cutter blade. The arm pivots around a stationary axle on the casing and carries the shaft at the end of which is fixed the knurl, the movement of this arm being controlled by a motor, a gear-work with reversing mechanism movable by a switch and a cam pivoting on a stop, so that the shaft of the knurl makes a round trip along a rise formed by an inclined and elongated opening on the removable cutting head. The lid of the can is thus automatically perforated and cut, and the can then turns in response to the mechanism actuation of reversing to free it when the knurl has returned to its rest position.

9 Claims, 15 Drawing Figures



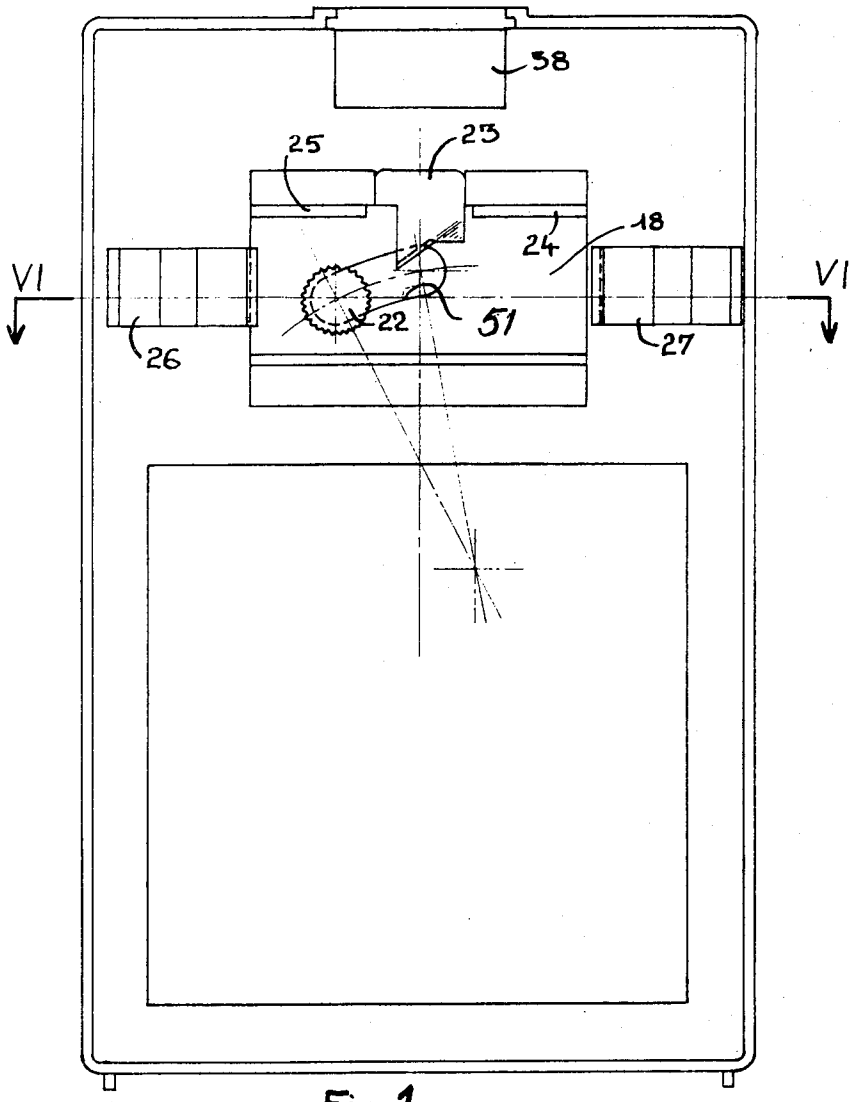


Fig 1

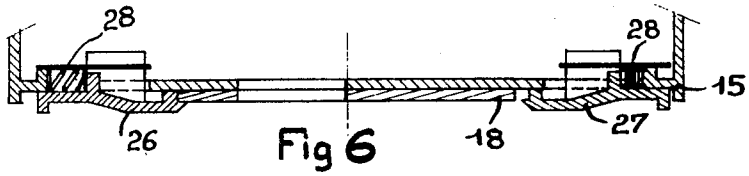


Fig 6

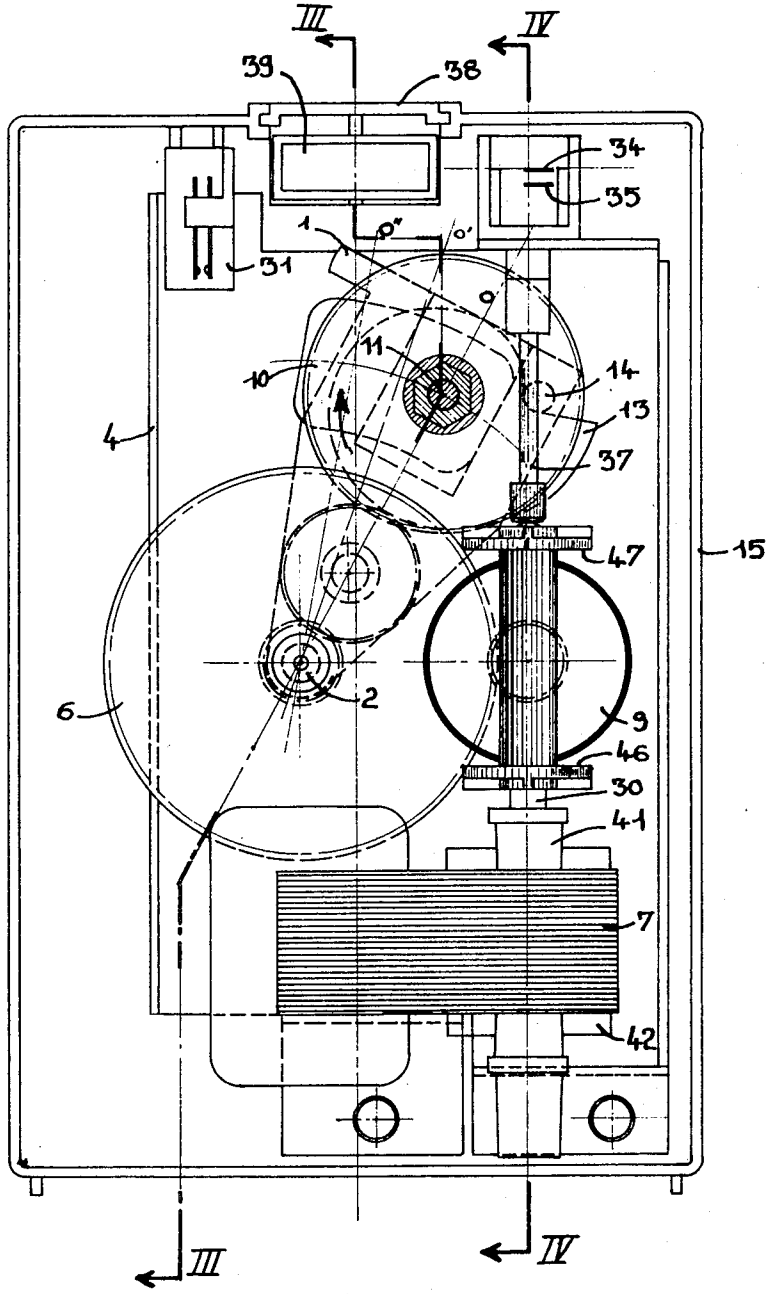


Fig 2

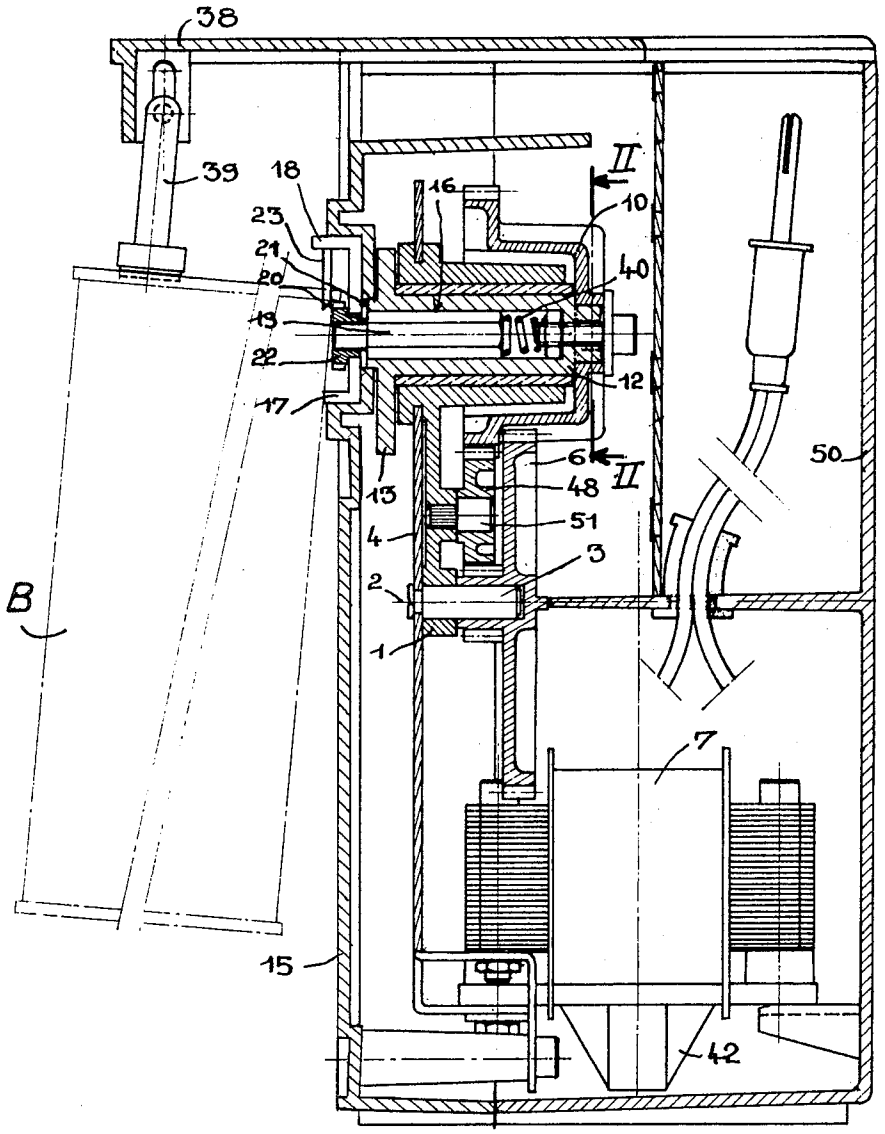


Fig 3

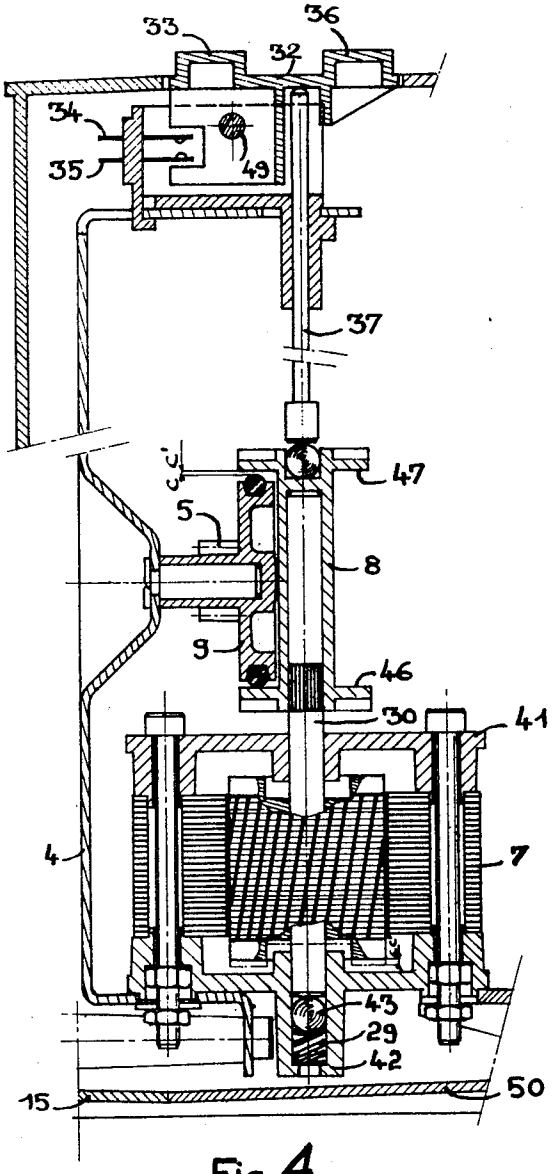


Fig 4

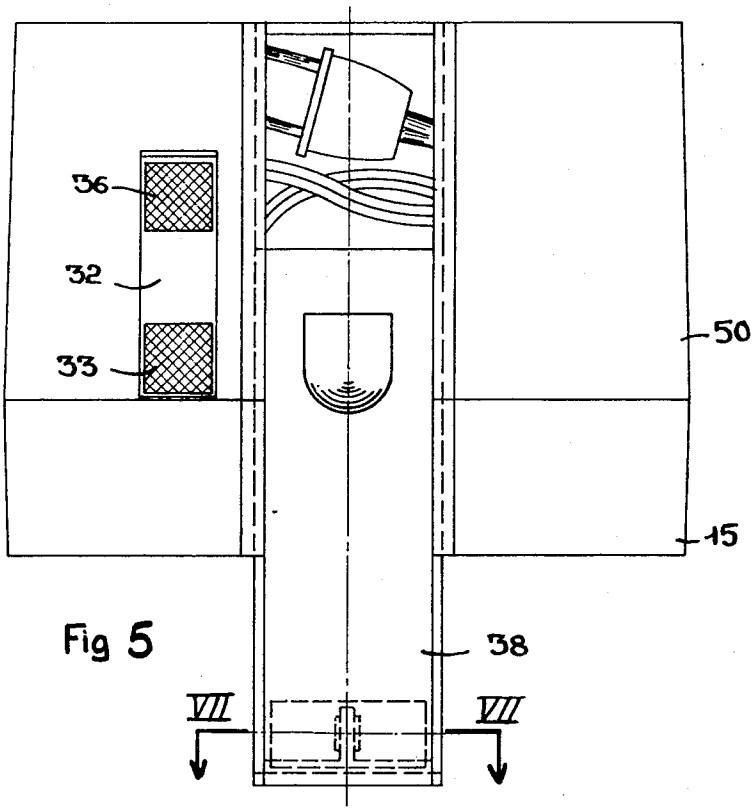


Fig 5

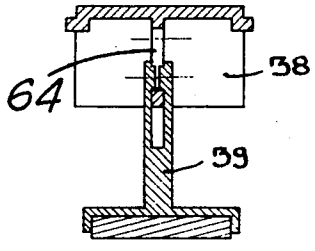


Fig 7

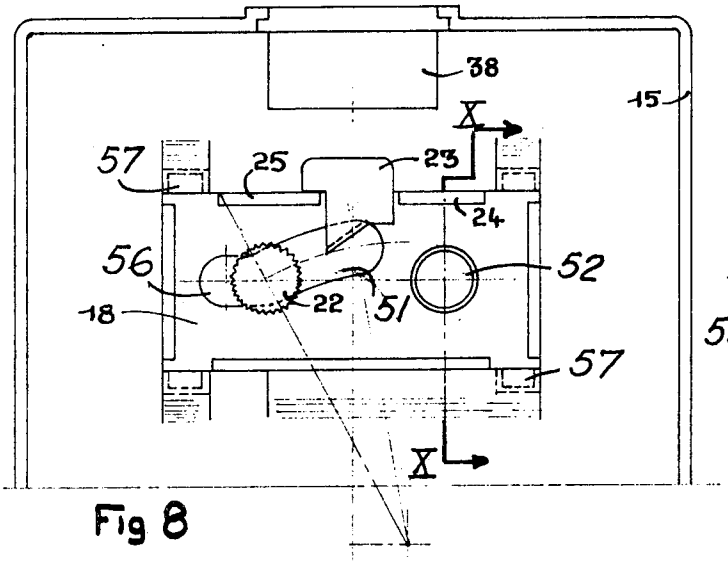


Fig 8

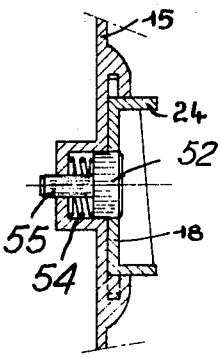


Fig 10

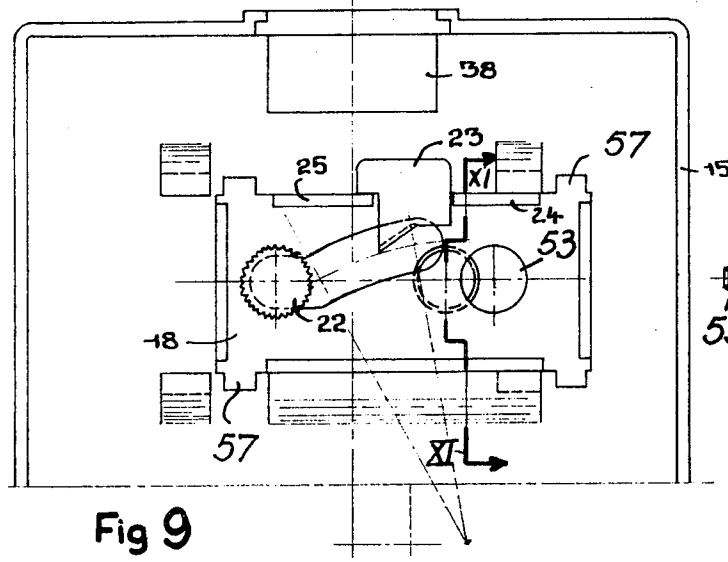


Fig 9

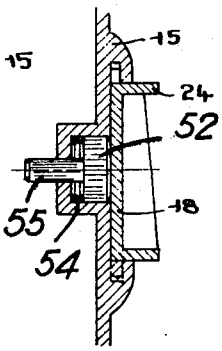


Fig 11

Fig 12

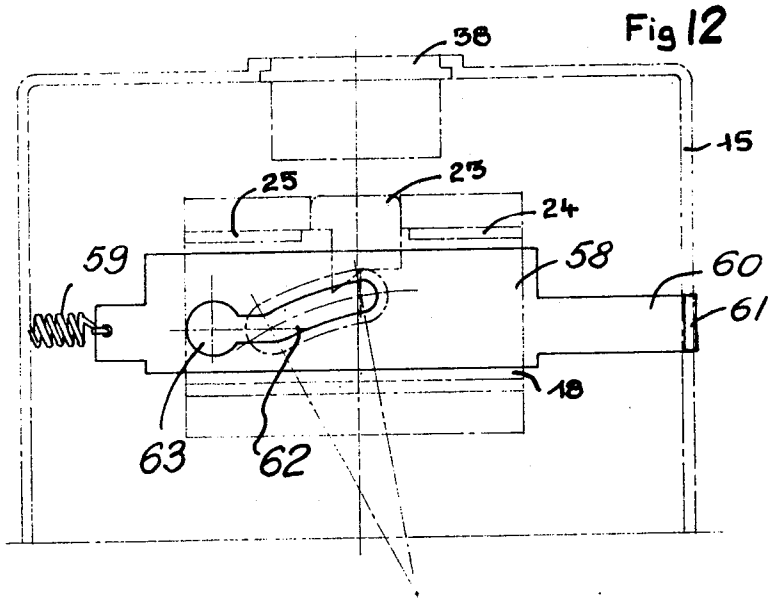
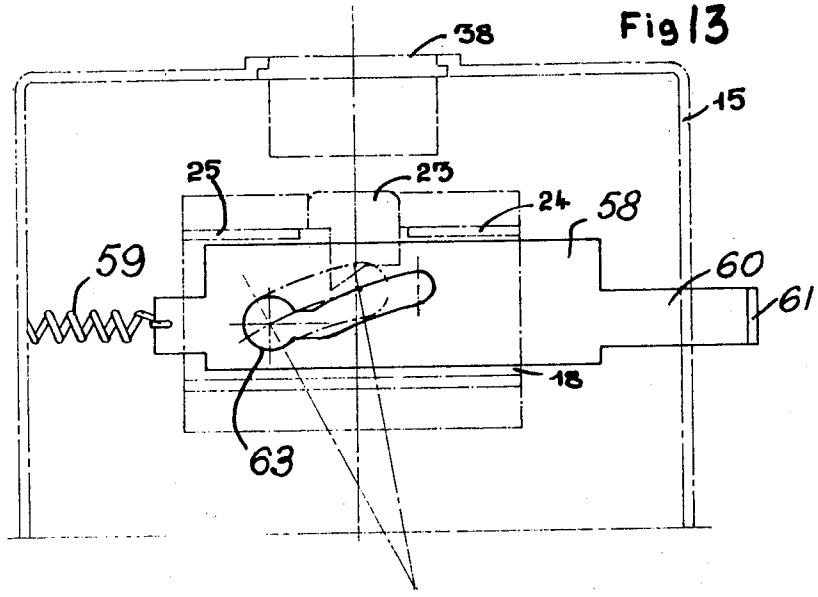


Fig 13



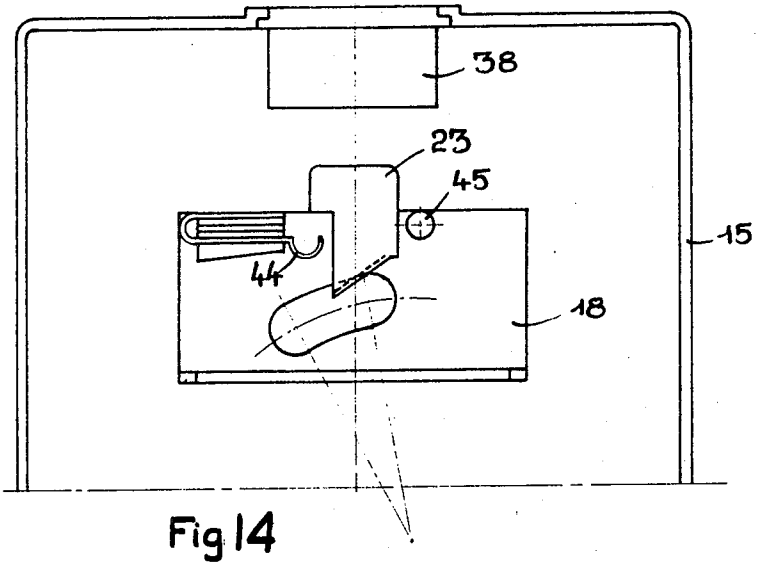


Fig 14

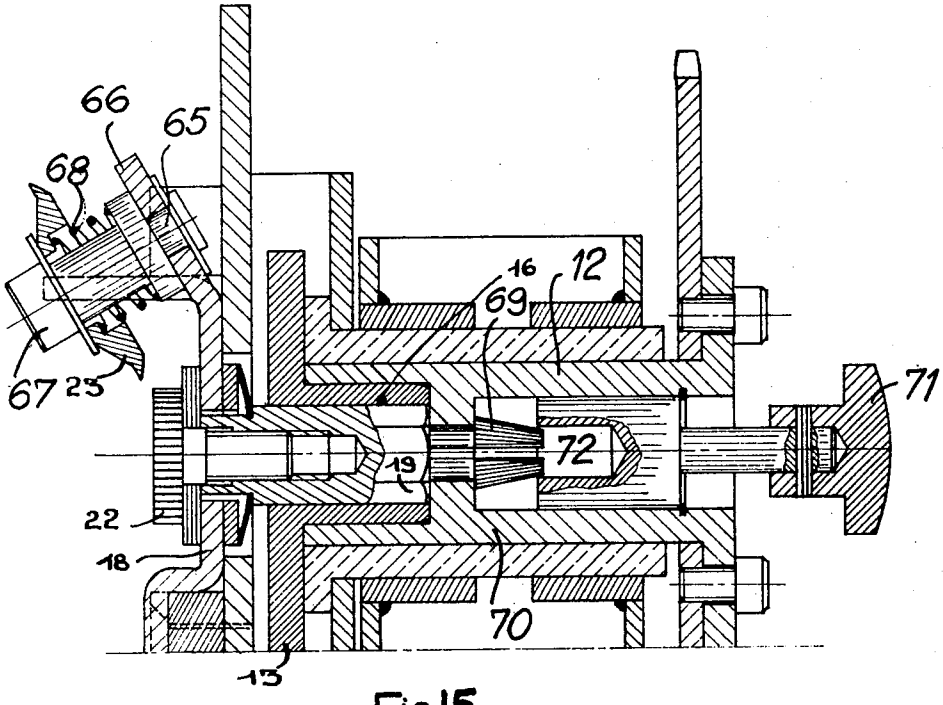


Fig 15

AUTOMATIC CAN OPENER WITH CAN DISENGAGEMENT THROUGH MOTOR REVERSAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electromotively operated can openers.

2. Description of the Prior Art

As a result of the considerable development of the production and use of metal cans, can openers driven by electric motors are beginning to be sought after by the electric household device clientele.

The devices of this nature which are presently found on the market, however, do not offer all the advantages for use that the user might except: in particular, they generally demand a certain manual effort by lever or other means, first to engage the lid cutting process, and then to disengage the open can from the cutting mechanism. Also, the cleaning of the cutting heads, that is, the guiding wheel of the can the cutting mechanism, cannot be done effectively and, finally, these devices have different outer projections jutting out which mar the esthetic appearance.

SUMMARY OF THE INVENTION

This invention proposes to remedy insofar as possible these different disadvantages.

It has as its subject an electrically driven device for the automatic opening of metal cans, using a driving knurl and cutting mechanism, characterized by the fact that it has an arm which is mounted to swing in a determined angle around a stationary axle on the housing of the device. The movement of this arm is controlled by a cam of appropriate contour working with a stop pin so as to produce successively the elevation along a short rise of the driving knurl of the can with automatic perforation of the lid of this can by the cutting mechanism and then cutting of the lid by rotation of the can, the rotor of the motor being tied to the driving gear-work of the cam and the knurl shaft by means of automatic reversing of the turn direction in order to bring, after cutting, the cam and knurl back to their rest positions with corresponding disengagement of the can.

According to a particular arrangement of the invention, the axle of the vertical rotor of the motor, arranged at the bottom of the device, is extended upwards by a transmission-rod on the head of which is mounted a two-contact reversing switch the rotation axle of which is placed so that manual action on one of the contacts exerts no force on the said transmission rod, while action on the second contact pushes towards the bottom of the rod and the axle of the motor lightly against a return spring and causes the reversing of the rotation direction of the gear-work.

According to a complementary arrangement of the invention, the axle part external to the motor rotates a coupling with two horizontal coil shaped end flanges, one or the other of these flanges driving by friction a roller with a horizontal axle communicating the motion to the gear-work, the reversing of the rotation direction being produced by transferring from the friction on the lower flange to the friction on the upper flange.

According to another arrangement of the invention, the removable cutting head is made up of a support plate pierced by an inclined and elongated opening

forming the elevation rise of the knurl, the said plate being tightened against the front face of the casing by ratchet motion during a frontal thrust, and lateral locking, due to two lateral locks pushed by springs, the upper edge of the plate having two stops for positioning the rim of a can during opening, and the cutting mechanism being fixed on the plate between the two stops, as well as against the driving knurl.

Other arrangements belonging to the invention will appear in the course of the following description referring to the attached drawing showing a non-limiting example of execution of the device according to the invention, with some variations in structure relative especially to the removable cutting head.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an upright front view of the device;

FIG. **2** is an upright rear view of the device with section following plane II—II of FIG. **3**, the rear closing plate of the hood of the device supposedly removed;

FIG. **3** is a sectional view following planes III—III of FIG. **2**;

FIG. **4** js a sectional view following plane IV—IV of FIG. **2**;

FIG. **5** is a view from above of the same device, with the magnet-carrying slide supposedly open in the position shown in FIG. **3**;

FIG. **6** is a sectional view following plane VI—VI of FIG. **1**;

FIG. **7** is a sectional view following plane VII—VII of FIG. **5**;

FIG. **8** is an assembling and structural variation of the removable cutting head;

FIG. **9** shows the removable cutting head of FIG. **8** during removal after unlocking;

FIG. **10** is a section following plane X—X of FIG. **8** showing the locking of the plate;

FIG. **11** is a section following plane XI—XI of FIG. **9** showing the unlocking of the plate;

FIG. **12** is a variation for locking the removable cutting head of FIG. **1**;

FIG. **13** is a view of the arrangement of FIG. **12** during unlocking;

FIG. **14** is a variation of structure of the removable cutting head; and

FIG. **15** is a variation in structure and mounting of the removable cutting head taken in the same plane as in FIG. **3.**

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. **2, 3** and **4,** a swinging arm **1** pivoting at point **2** on an axle **3** integral with a frame **4** receives driving energy at point **2,** through the intervention of a gear-work **5–6.** Thus, the arm **1** is driven in a determined rotation direction by energy proceeding from a motor **7** and transmitted by a wheel **8** and a friction roller **9** placed perpendicularly on the wheel **8** to pinion **5** (FIG. **4**). Pinion **5** transmits a movement to a reductive wheel **10** centered at point **11** on arm **1** and thus to a hollow shaft **12** which has on its front surface a cam contour **13** which, in rotation, hits on a pin **14** causes an angular displacement of arm **1** of a value determined by the cam contour. The hollow shaft **12** has a hexagonal interior contour **16** which projects past the exterior part of the frame **4** so as to become level with the exterior zone of the casing **15,** describing in the cas-

ing a movement centered at point 2 and limited to the angular displacement of the arm 1. Into this hexagonal lodging lodges the hexagonal axle integral with the cutting and driving assembly described later. The cutting head 17 (FIGS. 2 and 3) is made up of a support plate 18 having in its center an inclined and elongated opening 52 forming a rise for the wheel clearance of the hexagonal axle 19 according to a radiant plane centered on the point 2 of the frame 4. The hexagonal axle 19 is such that it receives (FIG. 3) on one of its ends a washer 20 which is locked on the shoulder 21 by holding tight the thickness of the plate 18 when the knurl 22 is screwed on the end of the axle 19. A play calculated for this assembly allows wheel clearance of the axle assembly 19 as indicated above.

This wheel clearance is characterized by three positions indicated as 0, 0', 0'' on FIG. 2.

- 0 is the position of the knurl at rest allowing the passage of the rim of the can under the cutting mechanism, thus in a stopped position of the device.
- 0' is the position of the knurl after maximum angular movement obtained by the effect of the cam 13 on the pin 14.
- 0'' is the position resulting from the residual angular course of the swinging arm 1 after freeing the cam 13 from the pin 14 and until complete pinching of the knurl against the rim of the can.

A cutting blade or knife 23 or other cutting mechanism (FIGS. 1 and 3) is assembled with the plate 18 in such a way that its positioning corresponds to that of the knurl in the can opening position.

Stops 24 and 25 (FIG. 1) grip the upper part of the rim of the can to be opened, when the blade is placed on the inside of the said rim and when the knurl engages the lower and outer part of the rim.

After introducing the male hexagonal axle 19 (FIG. 3) of the head into the hollow hexagonal 12 of the cam 13, the head assembly 17 comes into a predetermined position on the front outer face of the casing 15. It is maintained in this position by two locks 26 and 27 pushed by springs 28 on the casing 15 (FIG. 1 and 6) and which allow a locking of the element 17.

The hollow hexagonal axle-cam assembly 12-13 (FIG. 3) can have its rotation direction changed because of the friction driving device 8–9 (FIG. 4); which is activated by an axial displacement of the motor rotor axle 30, of a predetermined value against the bias of a spring 29, to engage of the friction wheel 9 alternatively with flange 46 or flange 47 of the wheel 8, thus reversing the rotation direction of the wheel 9. The axial displacement of the flange assembly 46 and 47, mounted on the rotor, is driven by tilting reverse switch 32 and a transmission rod 37. The spring 29 placed under the rotor 30 maintains permanently a pressure of the wheel 8 on the wheel 9 assuring a preferential rotation direction corresponding to the rotation direction of the knurl in the cutting position. The motor 7 has special bearings 41 and 42 of self-lubricating plastic; the lower bearing 42, in particular, is such that receives in a one-eyed bore, centered on the rotor, the said spring 29 supporting a ball 43. The flexion of the spring 29 allows, such as shown, an axial shift having a distance CC' which is necessary to the reverse friction driving. The axial displacement of the rotor of the motor is such that in the rotor position in which the flange 46 is in friction with the wheel 9, that is, in the rotation direction corresponding to the cut of a lid, the centering of the magnetic mass of the rotor in the flux, is maximal and that the force thus exerted adds to the force of the spring 29 and converges, on the one hand, in the maximum torque of the motor, and on the other hand, in the optimum friction thrust.

The swinging support arm 1 can be equipped, for the ease of blocking of the gear works, with an intermediate wheel pivoting on an axle integral with the swinging arm. It is only a question here of a kinematic variation without bearing on the general principle of the device. There has thus been provided a bell-shaped cogged crown 10 so as to take up the wiring unit and to create a free area inside the supply cable area, as appear in FIG. 3.

It is thereafter understood that by establishing the electric circuit closing—described later—the motor, driving the flange 46 rotates the cam 13. Cam 13 bearing on the pin 14 then displaces the swinging support 1 and thereby the axle 19 and its knurl 22 mounted on the head 17, in one axle such that the knurl, previously shown under the rim of the can to opened, the can having been suitably placed under the blade (or the cutting disk), thrusts the said can towards the blade with a force sufficient to assure penetration of the cutter. Although the knurl is already turning at this moment, the pinching of the can between the knurl, the blade and the stops is not yet complete because the rotation of 360° of the cam 13 has not been completed. The activation of rotation of the can has not yet begun; on the other hand, until as the punching of the can is carried out, that is, until the cam has almost completed its rotation and brought the swinging support arm into its course 0–0'. The turning knurl then engages the underside of the rim of the can, causing rotation of the can, while the blade no longer acts as punch, but as a cutter.

This is an important advantage of the functioning of the device because of the moment that the motor starts up the movement of arm 1, a static torque is necessary to pierce the can. On the other hand, when the cutting begins, the motor has already attained its breakdown torque. The advantage of this solution with regard to the one consistant with making the motor under load start under the cutting pressure is to permit a lower power, less expensive motor.

As elastic contact device 31 (FIG. 2) placed at the extremity of the swinging distance of the support arm 1 takes advantage of its movement in order to maintain under pressure the closing of the electrical feed circuit of the motor. At the complete cutting of the lid, the pinching force of the knurl under the rim is loosened, permitting a slight recoil of the swinging arm from 0'' to 0', under the elastic pressure of the contact device and thereby the reopening of the electrical circuit and thus the automatic stopping of the device.

Referring again to position 0' this position may be defined by the extremity of the ramp of the cam and farthest from the center that can rest on the lug 14. In this maximum position, the knife 23 is engaged in the top of the can since the knurl 22 is geared under the setting flange of the can and comes closer to the knife. However, according to the thickness of the flange, the knurl 22 can engage the knife 23 still more in the top of the can, and this until the top of the flange touches abutments 24 and 25. When the flange touches those abutments, the oscillating arm 1 is displaced to 0''. This travel 0' – 0'' is essential for: (1) suppressing the effect

of the lug **14** on the cam **13**, so that the cam can turn freely, (2) letting the height of the knurl **22** adjust itself in relation to the thickness of the flange, and assure its wedging under the flange, and (3) permitting the maintenance of contact **31** of the electric circuit.

The closing of contacts **31** occurs during the time when the knurl **22** remains wedged under the flange of the can, in reaction to the friction caused by the cutting of the knife in the top of the can and the friction of the flange against the abutments **24** and **25**.

As soon as the cutting of the top of the can is finished, the friction is reduced to that of the flange against the abutments **24** and **25**, and this permits the arm to come back to about its position **0'**. In fact, its true equilibrium position is located between **0'** and **0**, but as soon as the arm moves back, it frees the contacts **31**, stopping the motor. The arm is then located in a position in the neighborhood of **0'**, in the sector **0'0''**. It is then sufficient to reverse the direction of the knurl **22** so that the latter "rolls" under the flange so as to tend to bring back the arm past the position **0'**, in the sector **0'0**. As soon as line **0'** is crossed, the point of cam **13** is taken over by the lug **14**, and the effect of the couple resulting from the rotation of cam **13** supported by the lug **14**, produces a rotation of the oscillating arm toward the said lug **14**.

The arm **1** cannot retract of itself after the end of the cutting operation, since on the one hand the can rubbing against the lugs continues, and on the other hand, the knurl **22** becomes motionless.

Automatic stop and go are obtained in the following manner: by manually pressing at **33** on the switch **32** the electrical circuit of the motor is completed. We have seen that the oscillating arm **1** is displaced, first under the action of cam **13** on the lug **14**, then by the engagement of the knurl **22** under the flange of the can until wedging is accomplished. In the meantime, the end of arm **1** presses on the first blade of contact **31** which is applied on the second blade. Those two blades are in parallel with contacts **34** and **35**. Then, it is possible to release the pressure in **33** to free the contacts **34 – 35**, the electrical circuit being completed through contacts **31**. On the other hand, as soon as the arm returns backwards, at the moment when the cutting friction of the knife stops, the circuit will be broken, and the motor will stop. It will be sufficient to press at **36** on the switch **32** to cause the reverse in the direction of the gearing due to a clutch system **8 – 9** and close again the electrical circuit of the motor by the contacts **34 – 35**.

The regulation of the friction permits the choice of the suitable motor type.

The various controls are assured (FIGS. **2** and **4**) by the sole reversing switch **32** tilting on both sides of its axis **49** and of which one side of the tilting **35** assures the initial starting contact, by closing the electrical circuit, by a contact plate action **34** and **35**. The tilting in the reverse direction, by pressure on **36** acts simultaneously on the same plates **34** and **35** and by a differential stroke, on the rod **37**. Thus putting wheels **8** and **9** into position for reverse direction and the closing of the electrical circuit restarting the motor are effected by this second tilting. In this way, the opened can caught between the blade and the knurl is disengaged, since the knurl returns to the position **0**.

To sum up, the use of the device which has just been described takes place in the following manner:

At rest, all the mechanical parts of this device occupy the positions shown by FIG. **2**; the can B to be opened is placed, as indicated by FIG. **3**, the upper rim of the can pressing against the knurl **22** and the lid adhering to the magnet, of which the extension **38** has been pulled sufficiently forward. The contact piece **33** of the driving reversing switch is pressed against so as to close the contacts of the plates **34** and **35** (FIG. **4**) and start the motor **7**; the cam **13** begins to turn while pressing against the pin **14** and driving the arm **1**. The knurl **22** turns and rises along the opening **51** while driving the can B which is being introduced under the cutting part **23**. Under the action of the torque of the motor, punching and perforation of the cover first takes place, then the can begins to turn, under the action of the knurl, for cutting the lid. During this time, the pivoting arm **1**, which has moved from the right toward the left (FIG. **2**), closes the complementary contacts **31**. From this moment on, pressure may be removed from contact piece **33** and the current is maintained in the motor, as long as the cutting action continues.

When cutting is completed, cutting pressure stops and the pivoting arm **1** draws back from contacts, thus cutting the current to motor **7**.

The motor **7** is then started again by pressing this time on the contact piece **36** to produce course reversal of the gear-works. Pressure is maintained on the contact piece as long as the can turns in a reverse direction from the cutting direction; the knurl returns in this way to its rest position at the bottom of the opening **51**, while the cam **13**, which also is turning in a reverse direction, comes at a given moment to a stop and rests against pin **14**. The motor shuts off then and pressure is removed from contact piece **36**.

The opened can is released while the knurl falls back into its rest position, whereas its lid remains held by the magnet; thus it can be recovered and thrown away.

It is evident that multiple structural and assembly variants of the various parts of the device described above may occur without departing from the sphere of the invention, as it has been described above.

Thus the reversal of the rotation direction may be obtained by using motors of various types for direction reversal, the parts, cam, wheels, rollers, etc. for engaging kinematics may be modified in any way whatsoever and which is easily imaginable for a specialist.

There will, however, be explained below, within the framework pertaining to the movable cutting head or which allow an answer to the multiple little special problems posed by the great variety of cans available in the trade.

In the description of the device (FIGS. **1** to **7**), it has been pointed out that the cutting part **23** was, as shown, a cutting blade; it will be specified here that its form and the respective positioning of this blade and of the knurl **22** are such that they will satisfy the following conditions:

The lower extreme point of the blade is on a vertical passing at approximately **4** mm to the left of the axle of the knurl in cutting position, of which the rotation direction is, generally for this cutting counter-clockwise; this same point is then practically on a horizontal level with the axle of the said knurl, the angle of the cutting edge being almost 30° with regard to the horizontal; the setting of the cutting edge is located between the said blade and the rim of the can B at an angle equal approximately to 45°; this interior setting permits the cut-

ting without rough edge or undulation of the can lid. In the schematic illustration of the blade **23** in FIG. **1**, one can see a triangle located at the top and at the right of the cutting edge. This "right angle" triangle has its horizontal side connected to the sharpened edge and its vertical side is part of the base of the blade; this part of the blade is advantageously cut in profile.

The removel for cleaning of the movable cutting head is easily carried out: each of the two spring bolts **26** and **27** is pulled laterally, the axle **19** is pushed back by spring **40** frees the head completely, and the latter is automatically released (see especially FIGS. **1** and **3**).

In the movable head mounting according to FIGS. **8** to **11**, the ratchet bolt is made up of a pusher **52** inserted in an opening **53** of the plate **18** and normally pushed back by the spring **54** level with the outer face of this plate (FIG. **10**). The shaft **55** of the pusher penetrates into a corresponding opening in the casing. To take off the removable head, all that is required is to thrust the pusher against its spring to retract it, then to make the plate slide toward the right (FIGS. **9** and **11**), the lengthened and slanting opening **51** is extended on the left by a hollow **56** aligned horizontally and and at the bottom of which the knurl comes to lie. By freezing the bolts (**26, 27**) laterally, the removable cutting head can then be drawn forward. It will be observed that the latter, according to FIG. **8** is held in position while working by clips **57** entering into slots provided for on the casing.

In the mounting of FIGS. **12** and **13**, the bolt of the removable cutting head is made up of a sliding plate **58** subject to the return pressure of a spring **59** and of which the level **60** is terminated by a clip **61** which catches on the right lateral edge of the casing. The sliding plate contains an opening **62** corresponding to the lengthened and slanting opening **51** of the plate **18** and ending on the left with a small, round opening **63.** The latter permits while at rest the bolting of the knurl axle at the position in FIG. **13.**

The following arrangements, provided by the device of FIGS. **1** to **7**, permit its being adjusted to any can diameter and lid height: the arm **38** (FIG. **5**), from which is suspended support **39** of the magnet, is a slide coming out of the casing **15** and of which the opening is adjusted depending on the sizes or the shape of the can to be opened; as for the support **39** it has free play while oscillating within the depth of a slot **64** (FIG. **7**). Thus the position of the magnet may easily be adjusted to the diameter and lid height of the can. After opening the latter, the slide is driven back while closing inside the casing and on the front the magnet support, so that the closed casing unit does not show any projections; ti will be observed that the slide closes a free space in which the electric cord with its plug for supplying the motor can be placed.

In addition to these arrangements, the stops **24** and **25** of the same device can be replaced (FIG. **14**) by an elastic blade catch **44** and a stop pin **45**: in this way, height differences in can rims can be compensated for.

The sectional view according to FIG. **15**, taken from the same plane as that of FIG. **3**, shows a mounting variant of the cutting part **23** and of the plate **18** bearing that part; the latter is a disk which can be fixed in its working position, on an axle **65** held by a flange **66** of the plate, by screw **67** washer tightened against a clamping spring **68.** The hexagonal faced axle **19**, bearing at one end the knurl **22**, is provided at the other end with a split clamp closing expansible cone **69**, which allows ratching it on shoulder **70** at the bottom of the hollow shaft with hexagonal profile **16.** On the other side of this shoulder a pusher **71** turning and integral with the hollow axle **12** to cam **13** is provided for; this pusher shows a female cone **72** designed to contract under pressure the expansible cone until the ratcher mechanism is freed and its withdrawal allowed, when separation and dismounting of this assembly is desired.

The following materials can be used for the construction of the swinging arm support, friction flanges and wheels, gear mechanisms, axles, cam, magnet arm support, insulating support of the electric controller, casing, etc. according to the invention: thermotemperatures resins, thermoplastics and shaped metals, injected under pressure, partially fused powder etc. permitting the making of very elaborate pieces at reduced cost. The wheel **9** may contain (FIG. **4**) a groove in which is inserted a ring of semiflexible material and with nonskidding characteristics, a ring which may be easily replaced when worn.

What is claimed is:

1. In an electrically operated automatic can opener of the kind having an electric drive motor, a cutting knife, an arm pivoted for movement about a fixed axis, a rotatable knurl carried by the arm and driven by the motor through a drive connection, abutment means for engaging the flange of a can so that the flange can be wedged against the knurl, a rotatable cam for swinging the arm to move the knurl toward the cutting knife of effect perforation of the top of a can by the knife followed by cutting of the top of the can upon rotation of the can by the knurl, the improvement comprising means cooperating with the drive connection between the knurl and the motor for reversing the direction of rotation of the knurl after the top of the can has been cut out so that reverse operation of the knurl against the flange of the can causes the arm to swing in a reverse direction.

2. Apparatus as in claim **1** wherein the knurl includes a hexagonal shaft iftted into a complementary opening in the cam, the axis of rotation of the cam being coextensive with the axis of the hexagonal shaft and of the complementary opening.

3. Apparatus as in claim **1** wherein the means for reversing the direction of rotation of the knurl includes a friction drive coupling having a member driven by a shaft from the motor and arranged to engage another member in either of two positions corresponding to forward and reverse drive directions, said shaft and driven member being displaceable to effect said two positions, said means further including a manually operated lever for displacing said shaft and driven member to the reverse position and biasing means normally displacing said shaft and driven member to the forward position.

4. A can opener as in claim **1** which includes a support plate having an elongated inclined opening therein, and wherein a portion of said knurl resides in said opening and is guided thereby.

5. A can opener as in claim **4** wherein said cutting knife is fixed to said support plate and wherein said support plate carries two stops for engaging and posi-

tioning the rim of a can during a can-opening operation.

6. A can opener as in claim **5** wherein at least one of said stops is resilient in order to compensate for height differences in can rims.

7. A can opener as in claim **4** including a casing surrounding said motor, said arm and said reversing means, and means releasably securing said support plate to an exterior portion of said housing.

8. A can opener as in claim **4** wherein said support plate carries a sliding plate having an opening a portion of which is shaped to correspond to the opening in said support plate.

9. A can opener as in claim **1** including a hollow shaft which carries said cam at one end, said knurl being carried on one end of an axle fitted into a complementary opening in the cam and extending into said hollow shaft, the axis of the cam being coextensive with the axis of the axle and of the complementary opening, and means at the other end of said axle for releasably retaining said axle within said hollow shaft.

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