United States Patent

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[72] Inventor **John S. Ringler**
Hastings, Mich.

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[73] Assignee **Gulf & Western Industrial Products Company**
Grand Rapids, Mich.

[54] **APPARATUS AND METHOD FOR TRIMMING CAN BODIES**
11 Claims, 14 Drawing Figs.

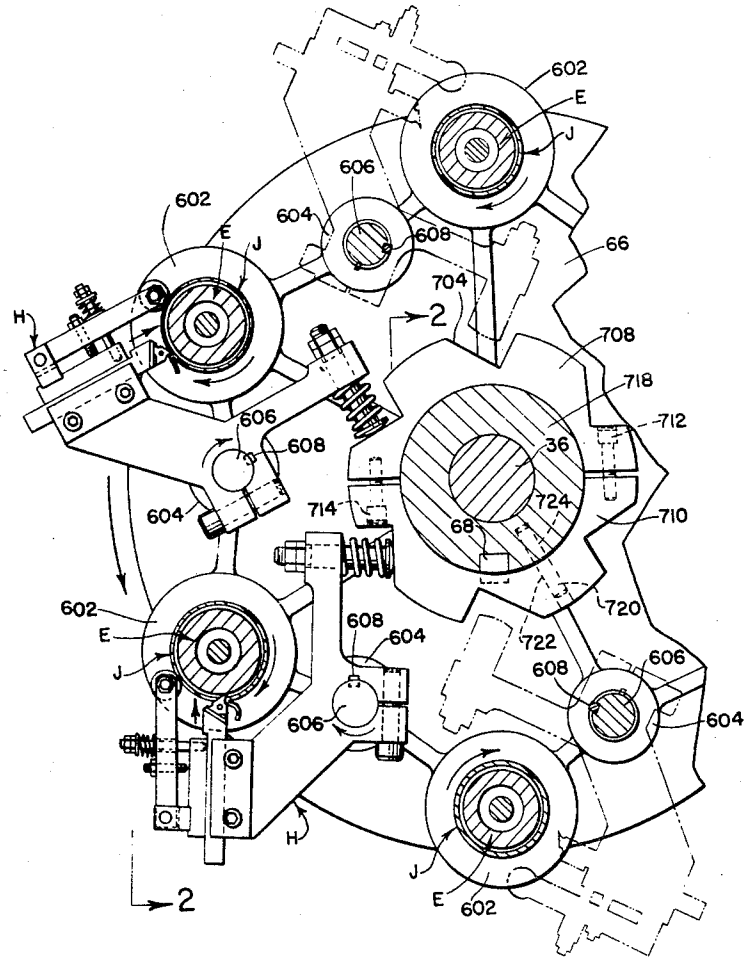
[52] **U.S. Cl.** **113/120,** 113/1, 83/914, 83/54
[51] **Int. Cl.** **B21d 51/00**
[50] **Field of Search** ..... 113/120 N, 120 H, 120, 7, 7 A, 116 R, 120 M, 1 G; 72/338, 340; 83/54, 42, 914; 82/47, 54, 58, 85, 3, 70.1, 82

[56] **References Cited**
UNITED STATES PATENTS

3,400,620	9/1968	Armbruster et al.	82/85
3,359,841	12/1967	Cvacho	83/54
2,298,366	10/1942	Gladfelter et al.	113/7
2,342,246	2/1944	Brueckner	82/82
2,702,597	2/1955	Wickwire et al.	82/54
2,443,963	6/1948	Ricciardi	82/82
2,350,535	6/1944	Sarulla	82/47

Primary Examiner—Charles W. Lanham
Assistant Examiner—Michael J. Keenan
Attorney—Meyer, Tilberry and Body

ABSTRACT: Cylindrical can bodies having irregular ends are circumferentially trimmed by a knife moving into engagement with a rotating can body. The knife is arranged to form a burr on the outside edge of the cut and the burr is swaged flat by a roller or flat tool following the knife. The knife and swaging means are on a common support movable toward and away from rotating can bodies. The swaging means may be independently spring biased toward a can body.

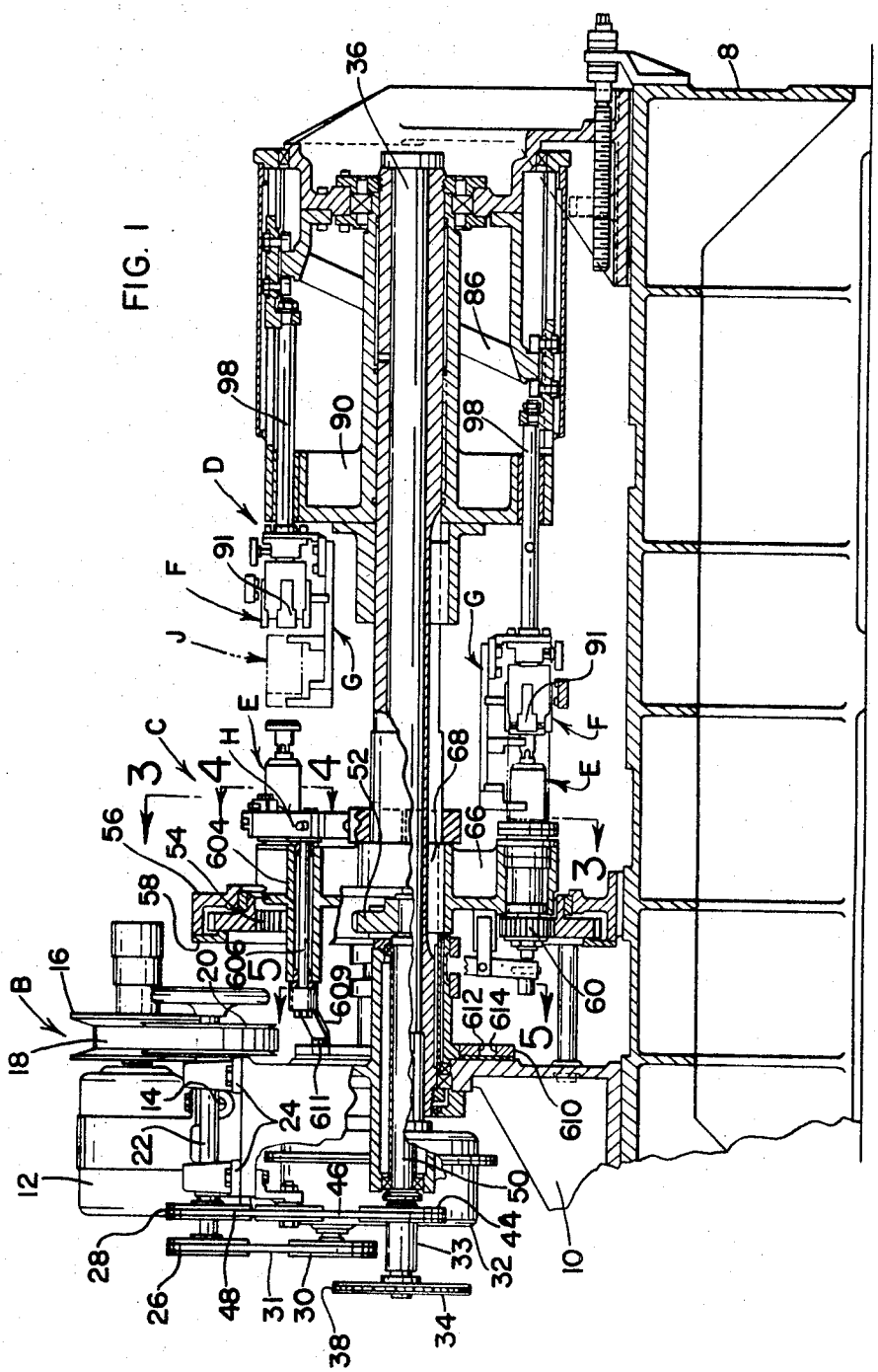


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SHEET 1 OF 5

FIG. 1



INVENTOR.
JOHN S. RINGLER

BY

Meyer, Tilberry & Body
ATTORNEYS

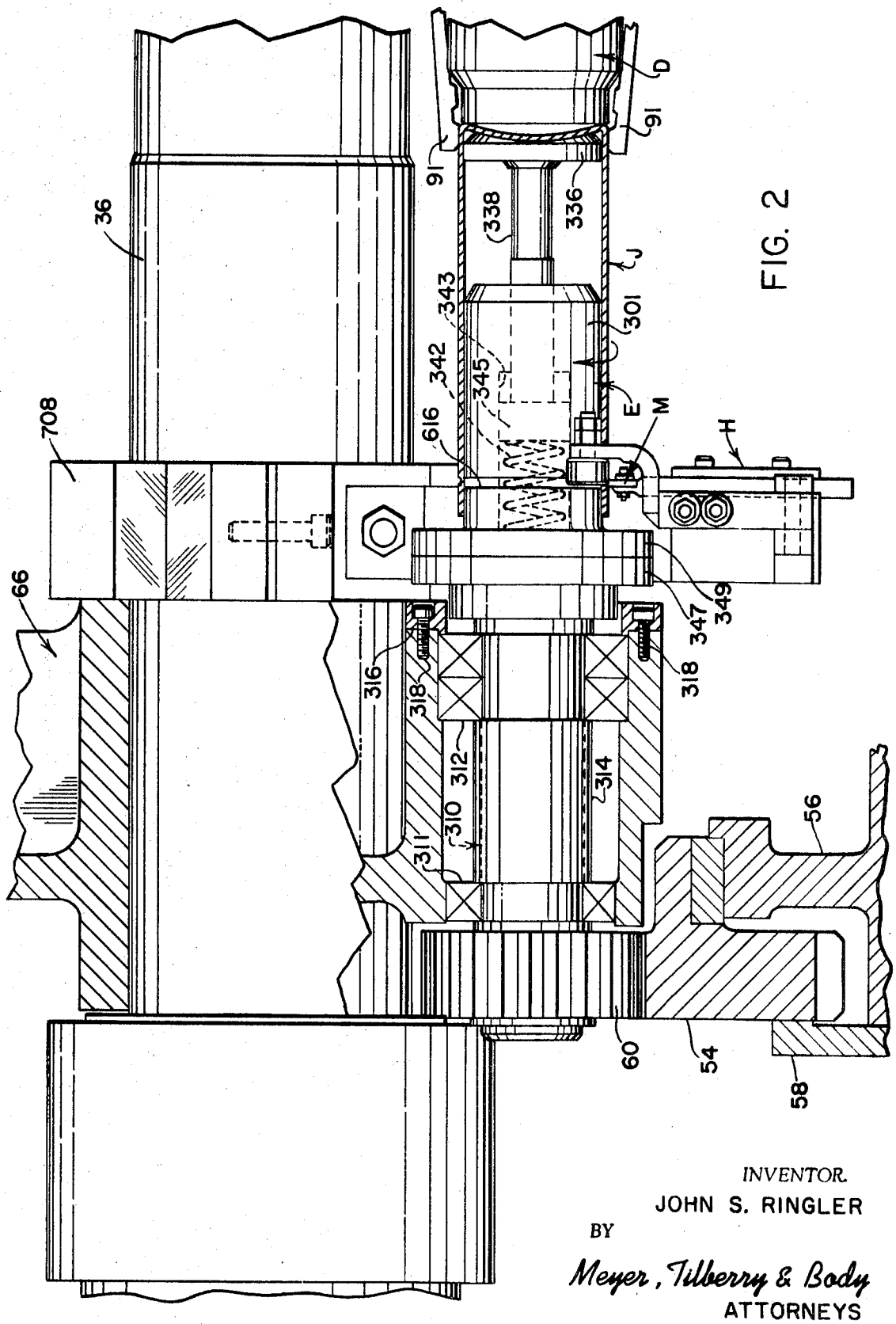
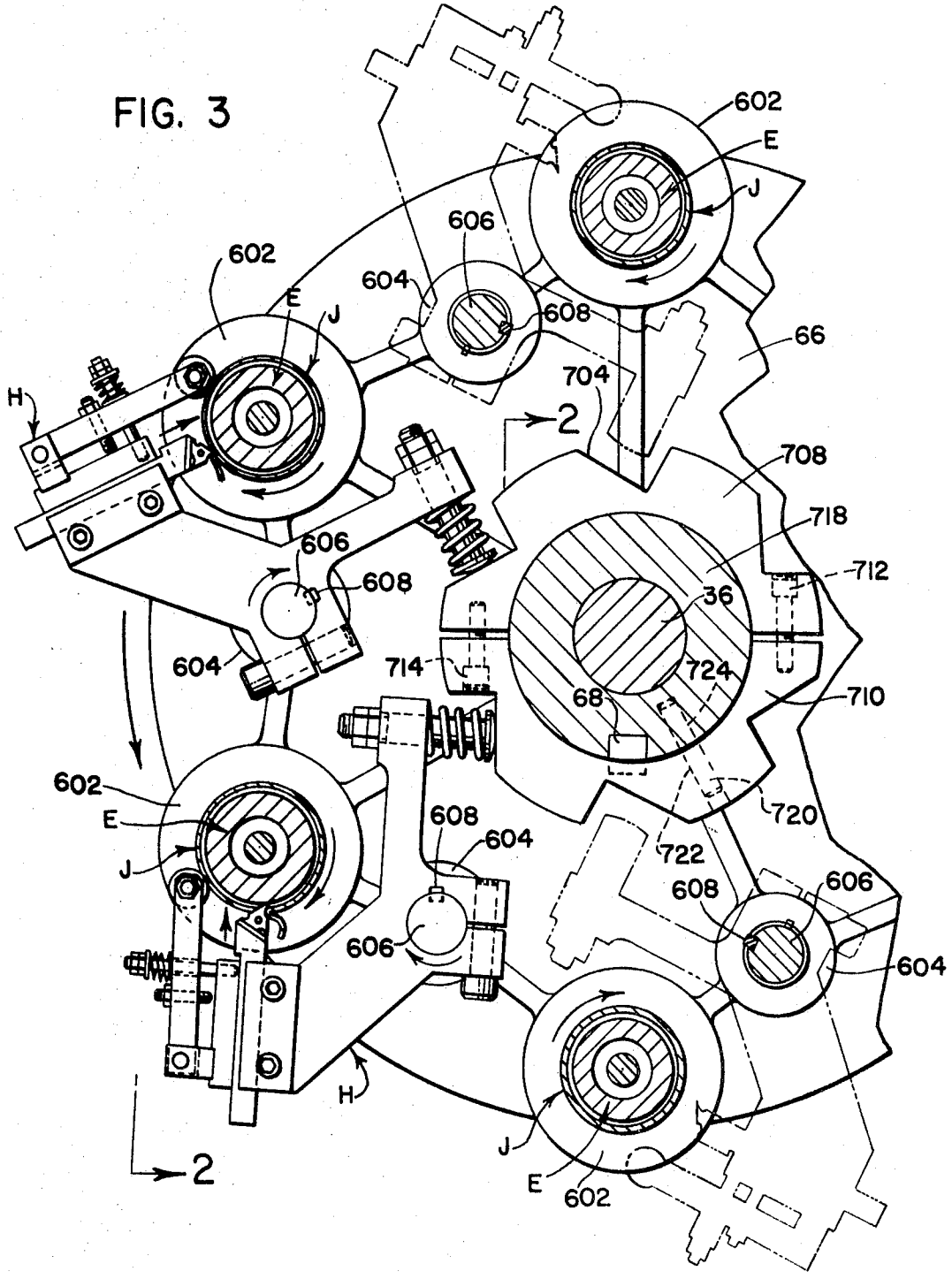


FIG. 2

INVENTOR.
JOHN S. RINGLER
BY
Meyer, Tilberry & Body
ATTORNEYS

FIG. 3



INVENTOR.
JOHN S. RINGLER
BY
Meyer, Tilberry & Body
ATTORNEYS

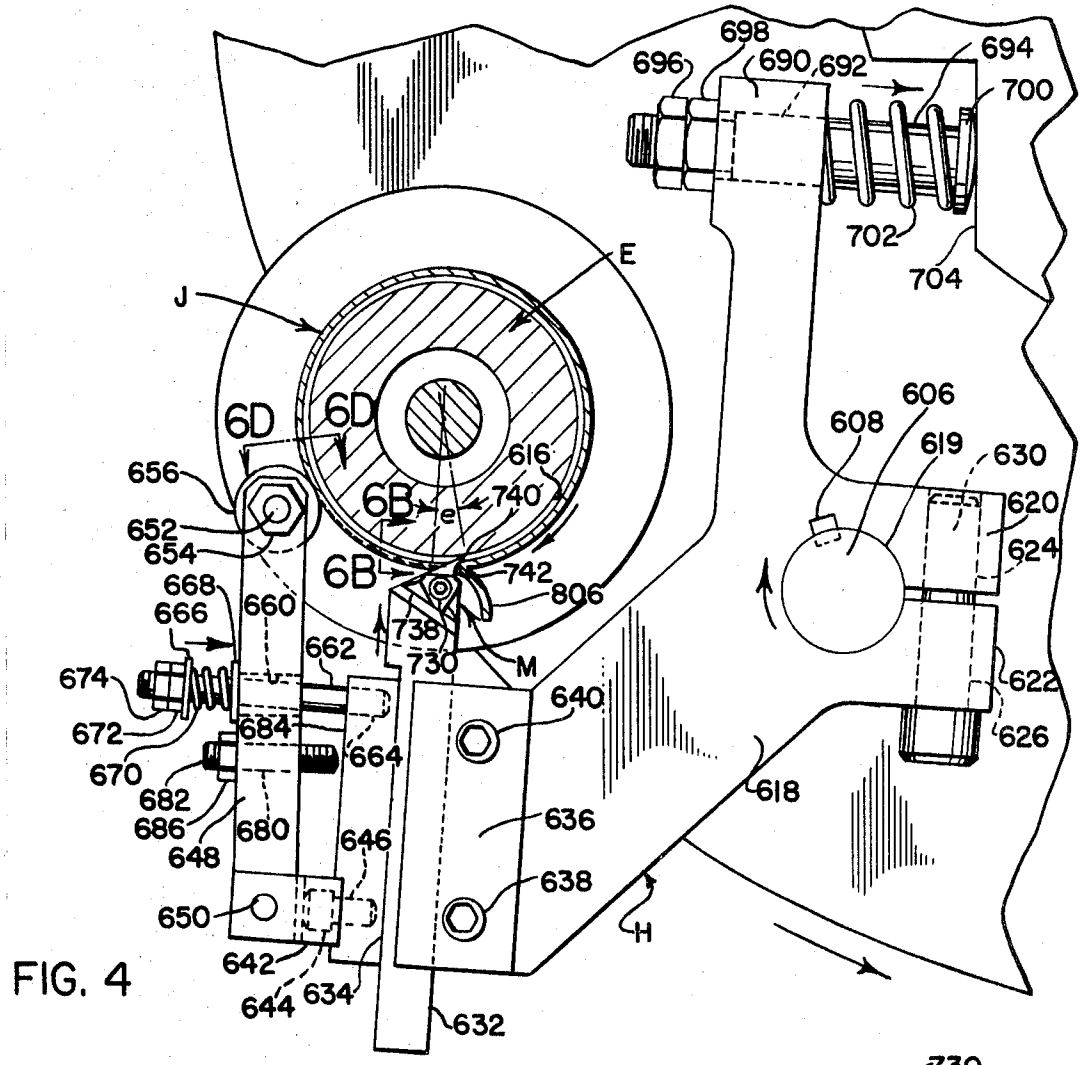


FIG. 4

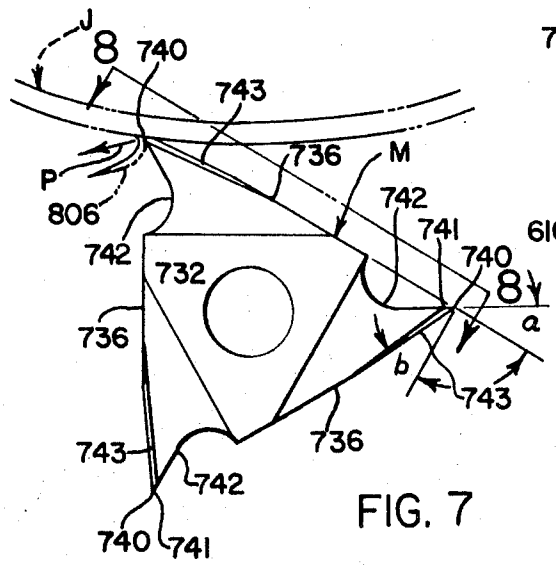


FIG. 7

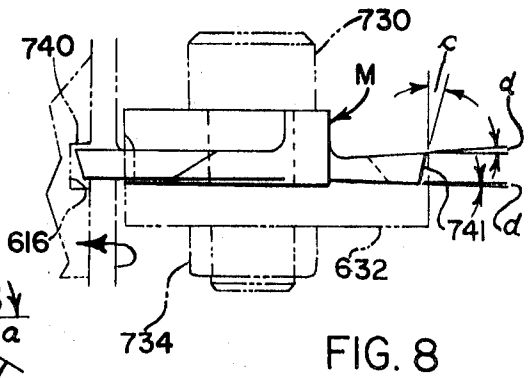


FIG. 8

INVENTOR.
JOHN S. RINGLER
BY
Meyer, Tilberry & Body
ATTORNEYS

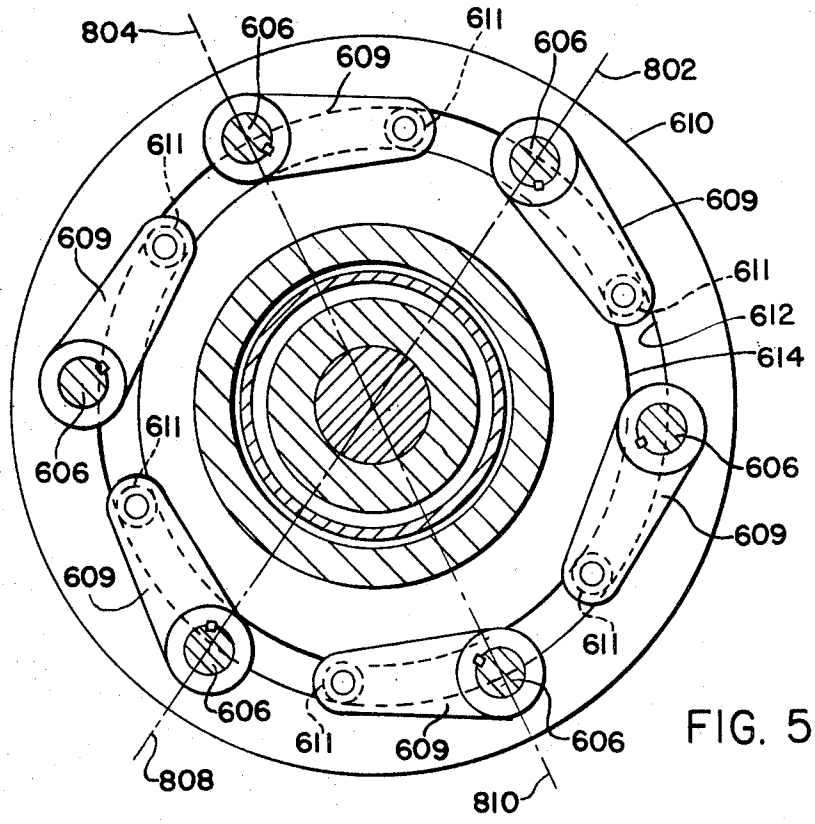


FIG. 5

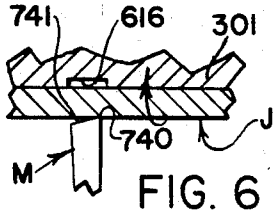


FIG. 6

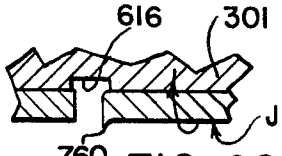


FIG. 6C

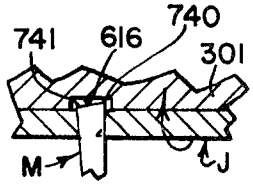


FIG. 6E

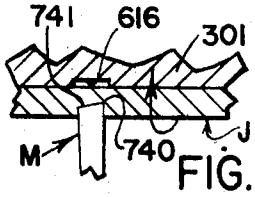


FIG. 6A

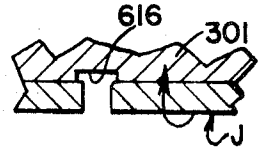


FIG. 6F

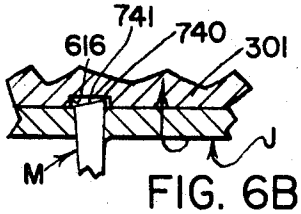


FIG. 6B

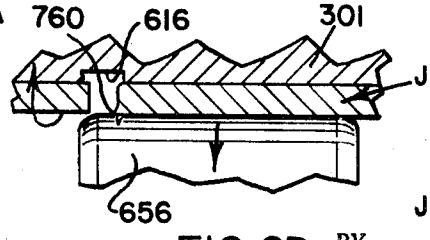


FIG. 6D

BY

INVENTOR.
JOHN S. RINGLER

Meyer, Tilberry & Body
ATTORNEYS

APPARATUS AND METHOD FOR TRIMMING CAN BODIES

BACKGROUND OF THE INVENTION

This application pertains to the art of metal cutting and more particularly to cutting cylindrical can bodies in trimming irregular ends.

The invention is particularly applicable to can making apparatus and will be described with particular reference thereto although it will be appreciated that the invention has broader applications and can be used for trimming or cutting other things than can bodies.

Cylindrical can bodies are commonly formed by extrusion, drawing or rolling flat sheets into cylindrical shape and welding a seam. In any can body, at least one end is usually irregular and requires trimming before a lid can be applied to the can body. Previous trimming apparatus usually leaves a sharp burr either on the inside or outside edge of the can body where the trimming cut is made. This burr interferes with subsequent operations in manufacturing a finished can and also interferes with application of a lid to the can. It would be desirable to eliminate this burr so that it would not interfere with subsequent operations or securement of a lid to the can body.

Previous apparatus for trimming irregular ends from can bodies include the type disclosed in U.S. Pat. No. 3,400,620 to Armbruster et al.

SUMMARY OF THE INVENTION

In accordance with the present invention, an apparatus for trimming irregular ends of can bodies includes a rotatable turret having a plurality of circumferentially spaced rotatable spindles. Can bodies received over the rotating spindles are rotated as the turret rotates. Cutting knives are pivotally mounted on the turret adjacent each spindle for pivotal movement toward and away from the spindles. Cam means on the apparatus pivots the cutting knives toward the spindles to pierce can bodies. Rotation of the can bodies against the cutting knife forms a circumferential cut in the can body. The knife is positioned so that a burr formed by the cutting operation is always pulled to the outside surface of a can body. A swaging roller mounted on a common support with the knife engages the can body at a cut to swage down the burr. Forming the burr to the outside of the can body and the swaging it down prevents interference by the burr with subsequent operations such as applying a lid to a can body or necking down the open end. The present invention is particularly useful for trimming drawn aluminum cans although other types of cans may also be trimmed with the device of the present invention.

It is a principle object of the present invention to provide an apparatus for circumferentially cutting irregular ends of can bodies in such a manner that no burr is left on the can body at the cut.

It is also an object of the present invention to provide such an apparatus which is dependable and automatic inoperation.

It is a further object of the present invention to provide such an apparatus with a swaging means which is yieldingly biased against the outer surface of a can body.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side, elevational view of an apparatus incorporating the improved trimming means of the present invention and with portions cut away from clarity of illustration;

FIG. 2 is a detailed, sectional view of a rotatable spindle and the trimming means of the present invention as positioned in the apparatus of FIG. 1;

FIG. 3 is a side, elevational cross-sectional view looking in the direction of arrows 3–3 of FIG. 1;

FIG. 4 is an end view looking in the direction of arrows 4–4 of FIG. 1;

FIG. 5 is a cross-sectional elevational view looking in the direction of arrows 5–5 of FIG. 1;

FIG. 6, 6A, 6B, 6C, 6E and 6F are detailed views looking in the direction of arrows 6–6 of FIG. 4 showing successive formation of a cut in a can body;

FIG. 6D is a detailed sectional view locking in the direction of arrows 6D–6D of FIG. 4 and showing swaging of a burr by the swaging means of the present invention;

FIG. 7 is a side elevational view of the trimming knives of the present invention; and

FIG. 8 is a view of the trimming knife of the present invention looking in the direction of arrows 8–8 of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein the showings are for purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting same, FIG. 1 shows a machine for trimming irregular ends of tubular can bodies. The machine includes drive assembly B, rotatable head turret assembly C, and tail turret assembly D.

Generally, the trimming machine comprises a main horizontal drive shaft 36 which is rotatably driven by drive assembly B. Positioned on the shaft and adapted to rotate therewith are a head turret 66 and a tail turret 90. Carried on head stock 66 are six equally spaced head turret spindle assemblies E. These assemblies are adapted to receive the can to be trimmed and hold it during the rotation of head turret 66.

Carried on the rotatable tail turret 90 are six tail turret spindle assemblies F and cull assemblies G. Each of these tail turret spindle and cull assemblies is carried on the ends of rods 98 that are axially aligned with the head turret spindle assemblies E and are reciprocated relative to tail turret 90 by a cam 86.

As the main drive shaft 36 is rotated, the head turret assembly C and tail turret assembly D rotate therewith. As each tail turret spindle assembly rotates, a can from a can feeding assembly is deposited in the arms of the cull assembly G. At this time, the rods 98 are withdrawn away from the head turret spindle assemblies by cam 86. The tail turret spindle is then actuated forward by the cam 86 and a vacuum and spring finger mechanism move with the can. As the tail turret continues to rotate the can body is fed onto the corresponding head turret spindle, and at this time, spring fingers 91 grip the can. Continued rotation causes trim knife assembly H to be actuated inwardly by a cam and sever circumferentially around the rotating can to remove the scrap end. As the turrets rotate, rods 98 are again withdrawn by cam 86, the can is withdrawn from the head spindle by the vacuum and spring finger mechanism carried on the tail spindle. The can is then discharged by a feed and discharge assembly.

Mounted at the left hand end of the machine base 8 is a cast drive support frame 10. Carried on the top of frame 10, on a guideway formed by parallel rods 14, is electric motor 12. This motor is adjustable along guideway 14 by a threaded rod and hand wheel assembly is a well known manner. Mounted on the drive frame 10, is pulley 20 which is driven by a variable pitch pulley 16 mounted on motor 12. The variable pitch pulley permits the speed of the machine to be varied. Pulley 20 is driven by motor 12 through belt 18; and it, in turn drives pulleys 26 and 28 through shaft 22 carried in bearing blocks 24. Pulley 26 is drivingly connected to pulley 30 to drive housing 32 by belt 31. Extending from housing 32, as viewed in FIG. 1, is the main drive shaft 36 which carries the rotatable head and tail turret assemblies. Extending from the left side of housing 32, as viewed in FIG. 1, is shaft 33 on which is mounted sprocket 34. Sprocket 34 is connected by a chain 38 to a sprocket that is keyed to a shaft which extends along the back of the machine and drives a can feed and discharge assembly.

Connected with pulley 28 through belt 48 and idler pulley 46 is pulley 44. Pulley 44 is mounted on a shaft 50 which extends along the front side of the machine, as viewed in FIG. 1, and is drivingly connected to a pinion gear 52. Pinion gear 52 drives ring gear 54 which is carried on ring gear guide bearings 56, and maintained thereon by retainer ring 58 which extends completely around the outer periphery of the ring gear and is

bolted to guide 56. As can be seen, rotation of ring gear 54 causes gears 60, which are engaged with the toothed internal periphery of the ring gear, to be rotated and thus rotate the head spindle assemblies E independent of the rotation of head turret 66.

Head turret assembly C comprises a generally circular head turret 66 that is connected for rotation with main drive shaft 36 by a key 68.

Rotatably mounted at equally spaced locations about the outer portion of head turret 66 are six head turret spindle assemblies designated generally as E. One of these spindle assemblies is shown in detail in FIG. 2 and comprises a main central spindle 310 carried in head turret 66 by bearings 311 and 312. Bearings 311 and 312 are spaced by a spacer member 314 and retained in the head turret by retainer ring 316 which is fastened to the head turret by screws 318. Mounted at the right-hand end of spindle 310, is spindle nose portion 301. Spindle nose portion 301 is of a diameter to fit within the can J to be trimmed and carry it during the trimming operation.

Extending from the right end of spindle nose 301 is rod 338 on which is mounted nose piece 336. Nose piece 336 is designed to assist in guiding can body J onto the rotating spindle nose 301 and to press against the bottom of the can J to maintain it snugly against the tail spindle assembly D. The bottom of can J is tightly gripped between nose piece 336 and tail spindle D so that can J rotates with nose piece 336 and head spindle E. Rod 338 may be square and fit through a square hole in nose portion 301 so that rod 338 and nose piece 336 rotate with head spindle E. Rod 338 and nose piece 336 are continually biased outwardly by a spring 342. Attached to the left end of spindle 310 is a pinion gear 60. As previously noted, rotation of pinion gear 60 by ring gear 54 causes spindle 310 and spindle nose portion 301 to be rapidly rotated independent of the rotation of head turret 66. Spring 342 is positioned within a recess 343 in nose 301 and acts against end 345 of rod 338. A pair of plates 347 and 349 are secured together to connect shaft 310 with nose 301 and spring 342 acts against the inner face of plate 349.

As shown in FIG. 3, head turret 66 has a plurality of circumferentially spaced bosses 602 in which head turret spindles E are mounted as previously described with reference to FIGS. 1 and 2. A plurality of other bosses 604 are provided on head turret 66 intermediate bosses 602. Bosses 604 rotatably receive shafts 606 on which trimming assemblies H are keyed as by keys 608. As shown in FIG. 1, shafts 606 extend through head turret assembly 66 and have a cam arm 609 secured at their rear ends. Cam arms 609 include a cam follower 611 positioned in a cam track having cam walls 612 and 614 of a cam member 610. Cam member 610 is nonrotatably fixed to frame 10. FIG. 5 shows that rotation of head turret 66 in a counterclockwise direction, as viewed in FIG. 3, causes shafts 606 to rotate counterclockwise. Counterclockwise movement of shafts 606 with heat turret 66 causes cam followers 611 on cam arms 609 to ride in the cam trace defined by walls 612 and 614.

In operation, a can J is delivered to a cull assembly G by a suitable feed mechanism as shown in FIG. 1. Cooperation of cam 86 with arm 98 causes tail turret spindle F and cull assembly G to move axially to the left as viewed in FIG. 1. This places a can body J over a head turret spindle assembly E as shown in FIG. 2. Head turret spindle assembly E rotates to rotate can body J. Cam follower 611 on cam arm 609 then moves into a trace of the cam defined by spaced-apart walls 612 and 614 to pivot cam arms 609 and shafts 606 clockwise as viewed in FIG. 5. Clockwise rotation of shafts 606 also cause trimming assemblies H of FIG. 3 to pivot clockwise. This brings the cutting knife of trimming assemblies H into contact with a can body. Continued rotation of a can body J against the knife causes a circumferential cut to be formed by the knife on a trimming assembly H. Continued rotation of head turret assembly 66 brings cam followers 611 on cam arm 609 back to a portion of the cam trace in which trimming assemblies H are pivoted counterclockwise as viewed in FIG. 3 so that the cutting knife of trimming assemblies H is moved away from can body J when a cut has been completed. The can is then free to be discharged to a discharge assembly in a well known manner. Head turret spindle nose 301 includes a circumferential recess 616 aligned with the knife on trimming assembly H so that the knife may pierce through the wall of a can body J with its point 740 received in recess 616.

Each trimming assembly H may include a support member 618 having an axial hole 619 receiving shaft 606. A pair of slightly spaced arms 620 and 622 are provided with aligned holes 624 and 626. Hole 624 is threaded for receiving threaded bolts 630 while hole 626 is large enough in diameter to freely receive bolts 630. Tightening of bolts 630 draws arms 620 and 622 together to tightly clamp on shaft 606. An elongated knife carrying member 632 is received in a groove 634 in support member 618. Knife carrying member 632 may be axially adjusted within groove 634. A clamping plate 636 is attached to support member 618 as by bolts 638 and 640 threaded into suitable holes in support member 618. Clamping plate 636 engages the outer surface of knife carrying member 632 to clamp it in position against axial movement in groove 634. The outer portion of support member 618 has a bifurcated bracket 642 secured thereto as by bolts 644 threaded into a suitable threaded hole 646 in support member 618. An elongated arm 648 is pivotally connected at 650 to bracket 642. The other end of arm 648 has a shaft 652 attached thereto as by nuts 654 and a roller 656 is rotatably journaled on shaft 652. Arm 648 includes a lateral hole 660 through which a threaded rod 662 extends into threaded engagement with a threaded hole 664 in support member 618. The diameter of hole 660 is substantially larger than the diameter of threaded rod 662. Threaded rod 662 has a pair of spaced washers 666 and 668 received thereon and a coil spring 670 is positioned around threaded rod 662 between washers 666 and 668. A pair of nuts 672 and 674 are threaded on the outer end of threaded rod 662 to hold washer 666 against outward movement on rod 662. Coil spring 670 acts against washers 666 and 668 to bias arm 648 clockwise about its pivot 650 so that roller 656 is in firm and yielding engagement with a can body J positioned on head turret spindle E. Arm 648 may have another threaded hole 680 threadedly receiving a threaded rod 682 whose end may butt against end face 684 of support member 618 to limit clockwise pivotal movement of arm 648 about pivot 650. Threaded rod 682 may be held in adjusted position within hole 680 as by nut 686. Support member 618 includes another extension 690 having a lateral hole 692 through which a rod 694 freely extends for axial movement. Rod 694 includes a threaded outer end receiving a pair of nuts 696 and 698 for maintaining rod 694 in an adjusted position relative to extension 690. Rod 694 includes a flattened end 700 and a coil spring 702 acts against extension 690 on flattened end 700 to normally bias rod 694 to the right as viewed in FIG. 4. Flattened end 700 normally bears against surface 704 when trimming assembly H is in cutting position. Biased rod 694 allows some over travel of trimming assembly H when it is moved to cutting position as described with reference to FIG. 5. Each trimming assembly H includes a biased rod 694 having an enlarged end bearing against a surface 704 on a stop member carried by head turret 66. As shown in FIG. 3, a pair of arcuate members 708 and 710 are secured together as by bolts 712 and 714 around a hub 718 on head turret 66. A pin 720 extends through a suitable hole 722 in arcuate member 710 and threads into a bore 724 in hub 718 to hold arcuate members 708 and 710 against rotation relative to head turret 66.

Knife carrying member 632 has a cutting knife M secured to it as by bolt 730 passing through a hole 732 in knife M. A nut 734 threaded onto bolt 730 on the other side of knife carrying arm 632. Knife M includes substantially flat surfaces 736 which bear against a flattened edge 738 on arm 632 to prevent rotation of knife M around bolt 730 during a cutting operation. Knife M includes sharp point 740, cutting edges 741,

front edges 742 and rear edges 743. Only one point 740 and cutting edge 742 is used at any one time and a new point and cutting edge may be brought into operation by loosening nut 34 on bolt 734 to reposition knife M on knife carrying arm 632. As viewed in FIG. 4, point 740 and cutting edge 742 engages can body J to the right of a vertical line through the rotational central axis of head turret spindle E. In addition, cutting edge 742 is angled rearwardly so that the reaction force as indicated by arrow P in FIG. 7 is always acting outwardly on can body J during a cutting operation. With this arrangement, the burr formed during the cutting operation is always pulled to the outside surface of can body J.

In the preferred arrangement, cam member 610 has its cam walls 612 and 614 defining a programmed trace. A can entering the head and tail turrets from a feed assembly may be represented by the position line 802 of FIG. 5. In this position, trimming assembly H is pivoted away from its adjacent spindle. As the turrets continue to rotate, the apparatus operates to position the can body over the head turret spindle as previously described. As the turret continues to rotate, the can body will be positioned over a spindle at a position as represented by line 804 in FIG. 5. The trace of cam member 610 then causes cam arm 609 and shaft 606 to pivot and bring trimming assembly H into engagement with the can body. The cam trace is programmed so that the cutting knife is gradually moved deeper into the can body as the turret rotates. In this manner, knife M successively peels a scrap portion of material 806 of FIGS. 4 and 6 from can body J. The cam trace of cam member 610 gradually moves the cutting knife deeper into the wall of the can body until the knife is completely through the can body when the turret has rotated to a position represented by line 808 of FIG. 5. In this position, point 740 of knife M will be completely through can body J and be received in circumferential groove 616 of spindle nose 301. As the turret rotates a can body from a position represented by line 804 to a position represented by line 808, a can body may make six complete revolutions with the spindle on which it is positioned. With this arrangement, cutting knife M gradually peels or cuts its way through the wall of a can body to completely sever the irregular end. The burr formed during each revolution of a can body is swaged down by swaging roller 656 so that the burr is removed by knife M during the next revolution of can body J. When the turret rotates so that the can body is at a position as represented by line 810 of FIG. 5, the trace of cam member 610 again pivots cam arm 609 and shaft 606 to move cutting assembly H away from its adjacent spindle and the trimmed can body is discharged from the apparatus.

FIG. 6—6F show a cutting operation. A can body J received on head turret spindle 301 is rotating in a manner previously described. Trimming assembly H is then pivoted to bring knife M into engagement with the outer surface of can body J. Knife M then begins cutting into the wall of can body J. Continued pivotal movement of trimming assembly H causes knife M to move further into the wall of can body J and successively cut deeper into its wall until point 740 of knife M is received in groove 616 in head turret spindle 301. Rotation of can body J and spindle 301 causes a circumferential cut to be formed in can body J and a burr 760 will be left on the outside surface of can body J at the cut. Roller 656 is in engagement with can body J following the cutting operation by knife M and roller 656 swages burr 760 downwardly substantially flush with the outer surface of can body J. Continued rotation of can body J on head turret spindle 301 will allow knife M to completely remove burr 760 in a manner shown in FIGS. 6E and 6F once burr 760 has been swaged down by roller 656 as shown in FIG. 6D.

In the preferred arrangement for cutting knife M, front edges 742 made an angle A with the extension of flat surface 736 of 30°. Rear edge 743 makes an angle B of 25° with a line perpendicular to the extension of flat surface 736. As shown in FIG. 7, rear edge 743 and cutting edge 741 is raked back at an angle C of 5°. As shown in FIG. 7, the opposite surfaces of each knife blade slope at angles D of 2°. It has been found that these angular relationships for cutting knife M provide insurance that the burr formed during the cut will always be pulled to the outside of the can body. As shown in FIG. 4, point 740 of knife M contacts can body J during a cutting operation at a position forming an angle E of around 20° from a line passing through the axial center of knife carrying arm 632 and through the rotational center of spindle E.

It should be recognized, that while a roller has been shown and described for swaging the burr following a trimming operation, it is within the purview of the present invention to utilize a nonrotating shoe which simply presses against the burr and swages it down. In addition, it is also within the purview of the present invention to use an abrading wheel or abrading shoe to grind away the burr instead of using a swaging roller. In this regard, it is also within the scope of the present invention to replace or supplement roller 656 with a secondary knife for peeling or cutting the burr from the trimmed periphery following a trimming operation. A spindle E and can body J make a plurality of revolutions during reception and discharge of a can body J by head turret 66 so that the burr may be progressively ground away during the plural revolutions of can body J following a trimming operation by knife M. In addition, it should be recognized that roller 656, or its replacement swaging shoe or grinding abrader, may be positioned immediately adjacent knife M to act on the burr immediately following the cut or on the opposite side of the knife so that the burr is not acted upon until can body J has rotated only slightly less than 360°. This is possible because spindle E and can body J rotate a plurality of revolutions subsequent to the trimming operation by knife M and prior to discharge of can body J from head turret 66. In this regard, roller 656, or a swaging shoe, abrading roller, or secondary trimming knife, may be positioned anywhere around spindle E between the cutting and trailing edges of knife M. Any of the various arrangements of a roller, shoe or abrader may be defined as an operating means for removing the burr from a trimmed edge of a can body.

While the invention has been described with reference to a preferred embodiment, it is obvious that modifications and alterations will occur to others upon the reading and understanding of this specification.

Having thus described my invention, I claim:

1. A device for trimming ends of tubular can bodies or the like having inner and outer surfaces comprising: cutting means for making a circumferential cut in said body, said cutting means being formed and positioned to form a burr on said body at said cut, said burr extending outwardly from one of said surfaces, and operating means positioned at a circumferentially spaced position from said cutting means for operating on said burr to aid in removing said burr from said can body at said cut.

2. The device of claim 1 and including holding means for holding said can body, and yieldable biasing means yieldably biasing and operating means against said burr.

3. The device of claim 1 wherein said cutting means is positioned exteriorly of said body and forms said burr extending outwardly from said outer surface.

4. The device of claim 3 wherein said can body has a longitudinal axis and said device includes means for rotating said can body about said axis, said cutting means and said operating means being mounted for movement toward and away from said body.

5. The device of claim 4 and further including common movable support means supporting said cutting means and said operating means, said support means being movable to move said cutting means and operating means toward and away from said can body.

6. The device of claim 5 wherein said operating means is movably mounted on said support means for movement toward and away from said can body and further including yieldable biasing means biasing said operating means toward said can body.

7. The device of claim 6 wherein said operating means is pivotally mounted on said support means on a pivot axis substantially parallel to said longitudinal axis of said can body.

8. The device of claim 6 and further including adjustable abutment means for adjustably limiting movement of said operating means toward said can body.

9. THe device of claim 5 wherein said support means is pivotally mounted on a support pivot axis substantially parallel to said longitudinal axis of said can body for pivotal movement to swing said operating means and said cutting means in arcuate paths toward and away from said can body.

10. The device of claim 5 wherein said cutting means engages said can body at a predetermined point and said operating means is positioned for engaging said burr at a position not greater than 90° from said predetermined point in the direction of rotation of said can body.

11. A method of trimming a tubular can body or the like having an inner surface and an outer surface comprising: rotating said can body and making a circumferential cut around said can body to form a burr extending outwardly from said outer surface at said cut, and removing said burr while continuing rotation of said can body.