March 17, 1964 C. H. KNODEL, JR. 3,124,872

METHOD AND APPARATUS FOR SEVERING A CONTINUOUS TUBE INTO CAN BODIES

Filed June 11, 1962 5 Sheets-Sheet 1

Fig. 3.

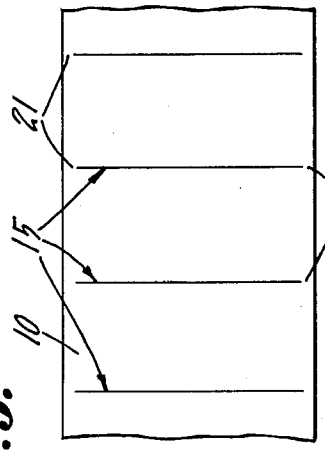
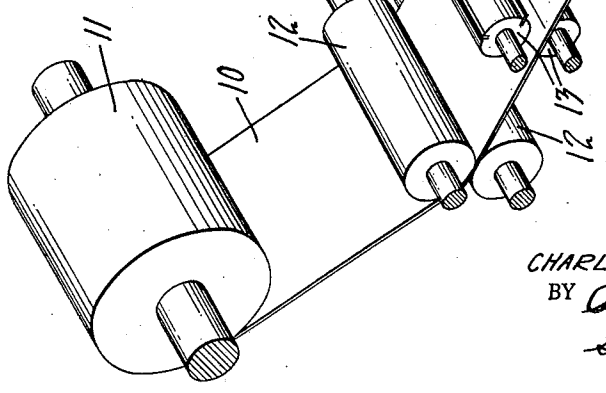


Fig. 2.

Fig. 1.



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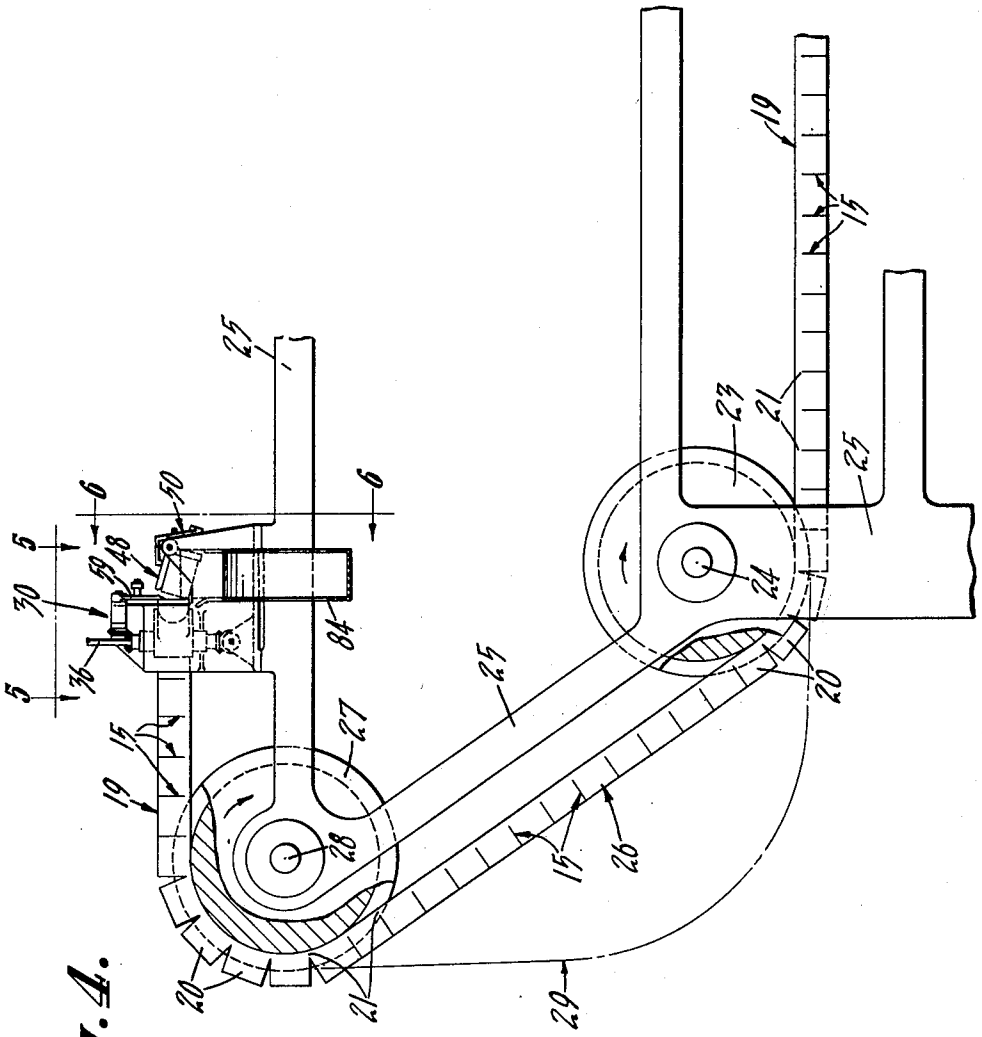


Fig. 4.

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METHOD AND APPARATUS FOR SEVERING A CONTINUOUS TUBE INTO CAN BODIES

Filed June 11, 1962 5 Sheets-Sheet 3

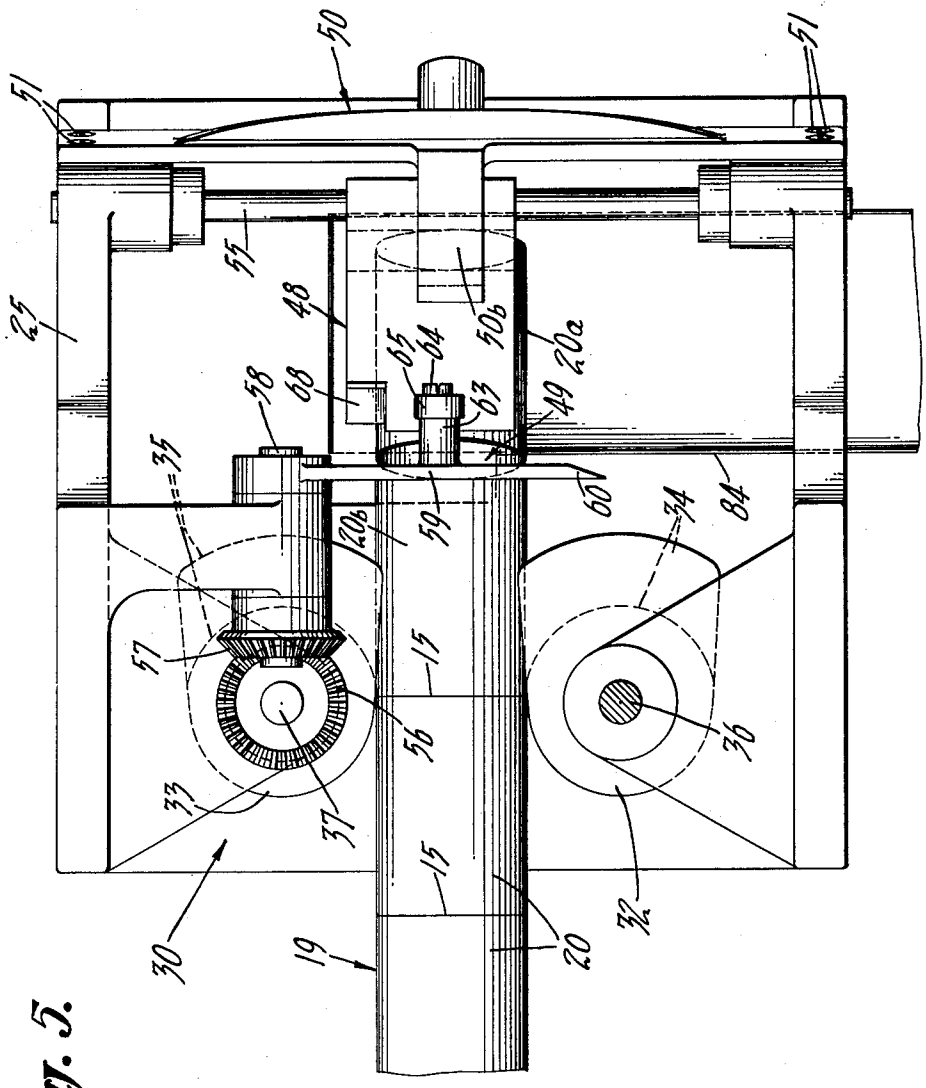


Fig. 5.

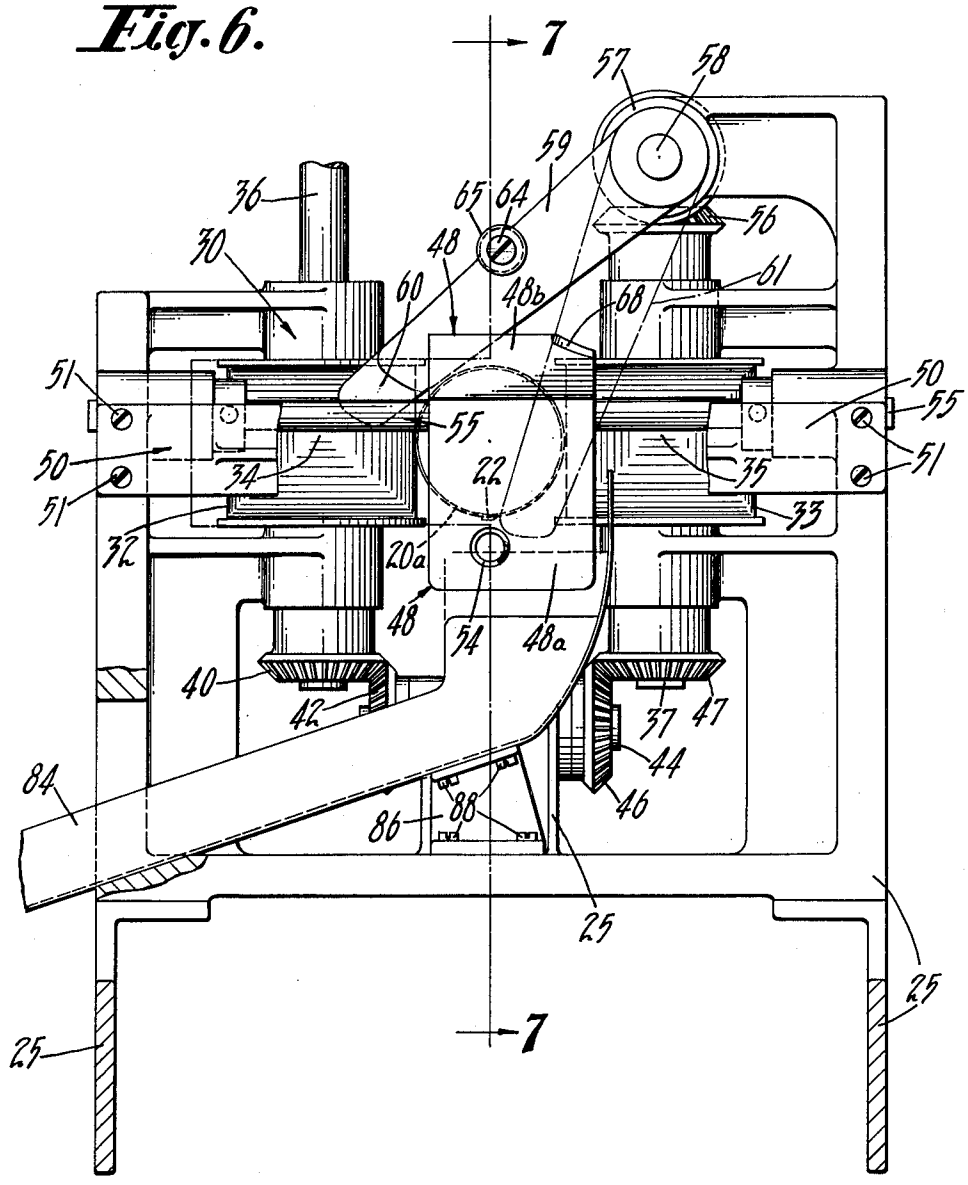
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METHOD AND APPARATUS FOR SEVERING A CONTINUOUS TUBE INTO CAN BODIES

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Fig. 6.



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METHOD AND APPARATUS FOR SEVERING A CONTINUOUS TUBE INTO CAN BODIES

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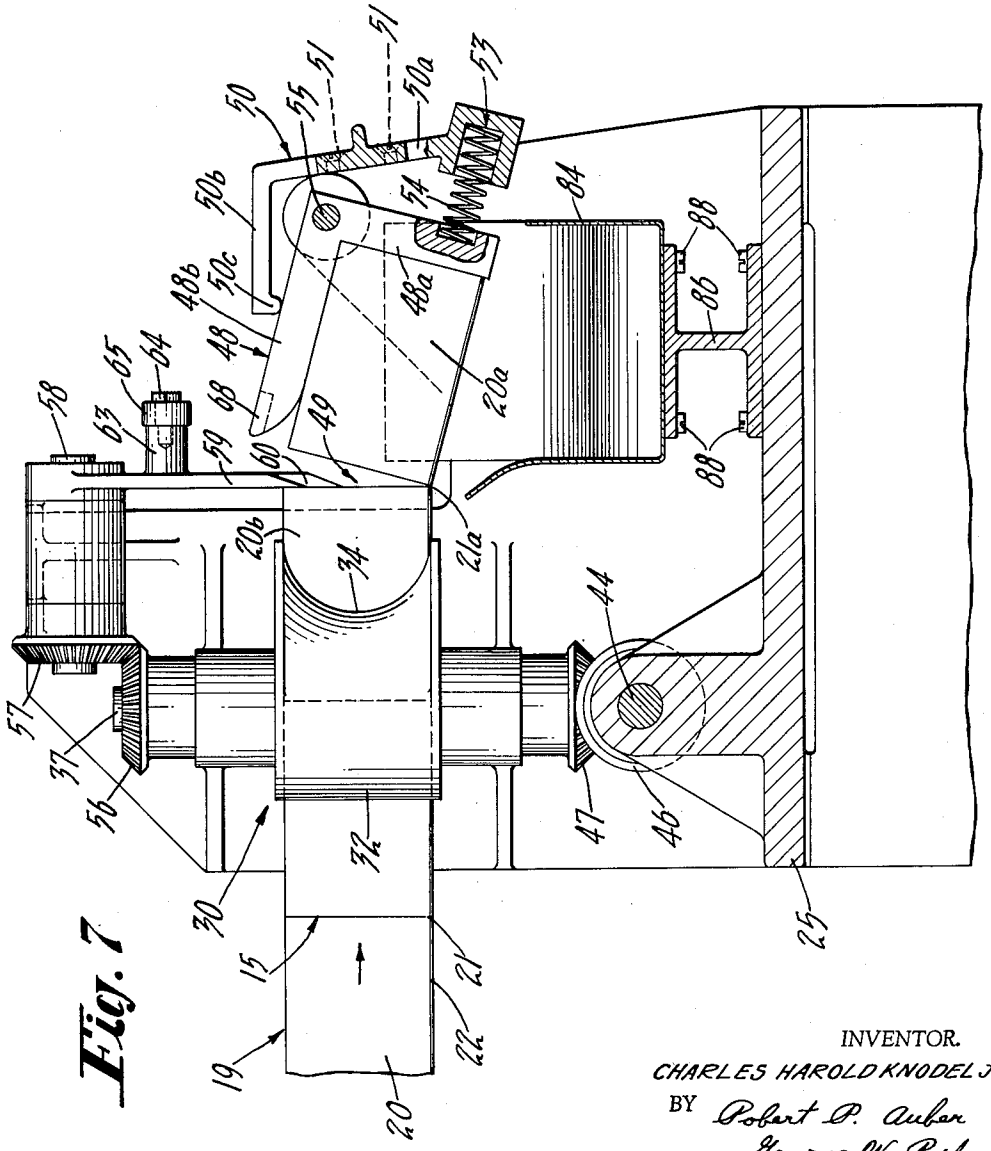


Fig. 7

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United States Patent Office

3,124,872

Patented Mar. 17, 1964

3,124,872

METHOD AND APPARATUS FOR SEVERING A CONTINUOUS TUBE INTO CAN BODIES

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Filed June 11, 1962, Ser. No. 201,656

10 Claims. (Cl. 29—413)

The present invention pertains to separating a continuous tube, which is already separated around the major portion of its circumference, into predetermined lengths. More particularly, it is concerned with a method and apparatus for the intermittent separation of a continuous tube into short lengths suitable for can or container bodies.

The present invention is applicable to the separation, into predetermined lengths, of a partially slit tube of any flexible material such as plastic, paper, or other fibrous material, or metal even up to a relatively heavy gauge. However, for the purpose of this disclosure and explanation, the invention will be described hereinafter in relation to the formation of tubular, light gauge, metal can bodies. The cross-sectional configuration of the can bodies denoted by the terms "tube" and "tubular" as used herein is meant to include polygonal, e.g. square, rectangular, hexagonal, etc., as well as circular.

The can making industry has long recognized the advantages of making can bodies from sheet steel in coil form. In this method of manufacture the steel is continuously fed from the coil into a tube-forming machine wherein the marginal edges of the sheet are joined, such as by welding, soldering, etc., and thereafter the resulting continuous tube is separated into individual can bodies. This general method has been practiced for many years in the manufacture of relatively thick-walled metal tubes. It is only recently that a commercially feasible method has been discovered for separating thin gauge metal tubes into individual can bodies.

It is an object of this invention to provide a method and apparatus for rapidly and accurately separating a continuous tube composed of any flexible material into predetermined lengths.

Another object is to provide a method and apparatus for separating a continuous, thin-walled, metal tube into individual can bodies rapidly and accurately.

A further object is to provide a method and apparatus of the class described whereby no undesired burrs or slivers remain on the individual separated lengths.

A further object is to provide means for intermittent severing of predetermined lengths from the forward end of a continuously formed tube.

A still further object is to provide means for changing the continuous movement of the tube, along a portion of its path, to the intermittent movement necessary for separation of the individual bodies.

An additional object is to provide means for separating predetermined lengths from the continuous tube and removing these lengths from the tube's path of travel.

Yet another object is the provision of a method and apparatus of the character described which may be used to provide individual, predetermined lengths having a cross-sectional configuration other than circular, e.g. square, polygonal, etc.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

The above objects are obtained by providing a continuous tube moving along a straight-line path of travel with the wall weakened, such as by scoring or slitting, transversely around the greater portion of its circumference at predetermined intervals. However, the wall is integral and unweakened along a longitudinally extending portion of the tube. In the instant method the tube is passed continuously along a straight-line path of travel wherein the tube does not separate along the weakened lines. Then the tube is passed along an arcuate path wherein the weakened portions open to V-shaped spaces and the tube then continues in a substantially straight line lateral path to an indexing and severing element. The foremost predetermined tube length is then directed away from the tube's path of travel to again open a V-shaped space. At this point, the integral portion at the apex of the V-shaped space remains stationary for a time interval and a severing element is inserted into the space and separates the foremost length from the remainder of the tube. The severed element is then removed from the path of the tube while the unsevered portion remains stationary.

In order to change the continuous motion of the tube to the intermittent motion necessary for severing the predetermined lengths, means are provided between the aforementioned straight-line path and severing means to vary the length of the tube. Indexing means are also provided to advance the tube along the lateral path of travel in an intermittent motion, in timed relationship with the severing and removal of the predetermined foremost tube lengths.

Referring to the drawings:

FIGURES 1 and 2 are continuing perspective views of one form of apparatus for carrying out the steps of slitting transversely the flat strip stock as it comes off a coil thereof and forming this slit stock into a continuous tube;

FIGURE 3 is a plan view of a portion of the transversely slit flat strip showing the position of the slits relative to the edges of the strip;

FIGURE 4 is a side elevational view of the apparatus for changing its continuous motion to intermittent motion; and for severing the predetermined lengths from the continuous tube;

FIGURE 5 is an enlarged plan view of the indexing and severing mechanism, taken as indicated by the line 5—5 in FIGURE 4;

FIGURE 6 is an enlarged fragmentary sectional view taken substantially along line 6—6 in FIGURE 4; and

FIGURE 7 is a sectional view of the indexing and severing mechanism taken substantially along line 7—7 in FIGURE 6.

As a preferred or exemplary embodiment of the invention, the drawings illustrate the method and apparatus for carrying out the present invention. A strip 10 of sheet metal, such as tin plate, black plate or the like, is supplied from a coil 11 of the material. The strip 10 is of a width approximately equal to the circumference of the can bodies to be produced and of a length sufficient to provide a considerable number of can bodies. The unwinding of strip 10 from coil 11 and the feeding of the strip for subsequent operations is performed by a pair of feed

rollers 12 which frictionally engage the upper and lower surfaces of the strip disposed between the rollers. After passing between the rollers 12, the strip 11 passes between a pair of opposed rollers 13, the upper one of which carries one or more transversely extending knives 14 and the lower one has cooperating recesses (not shown) for the purpose of slitting the strip 10 transversely along a portion of its width. The rotation of the knives 14 as the strip 10 passes between the rollers 13 produces a series of slits 15 at spaced intervals along the length of the strip in accordance with the length of the can bodies to be produced. As best shown in FIGURE 3, the slits 15 extend across the central portion of the strip 10 but terminate just short of the marginal or side edges of the strip.

The partially slit strip 10 then passes between a series of forming rollers 16 and around a mandrel 17 (FIGURE 2) whereby the strip is gradually brought into tubular shape with the unslit marginal edges overlapped. These overlapped marginal edges are then securely bonded to one another, such as by passing them under a rotating resistance welding electrode 18 to form a continuous tube 19. Although the tube 19 is partially divided into potential can bodies or cylinders 20 by virtue of the spaced slits 15, it remains an integral, unitary structure by virtue of the unslit portion 21 including the bonded side seam 22.

Actual formation of the tube 19 forms no part of the instant invention, the above description being for the purpose of clarity and continuity. If desired, other methods and apparatus may be used to form the tube 19 having the spaced slits 15 and the longitudinally extending unslit portion 21. One such other method is that shown in United States Patent 2,187,740 issued to John M. Hothersall on January 23, 1940, wherein the tube is composed of a series of cylinders formed from individual flat blanks and integrally connected along their bonded side seams.

After bonding the overlapped marginal edges, the continuous tube 19 is fed along a straight-line path of travel (FIGURE 4) until the unslit portion 21 engages the periphery of a rotary guide 23 secured on a shaft 24 that is journaled in a frame 25. The rotary guide 23 changes the path of travel of the tube 19 from the straight-line path to an angularly upward path 26, until the unslit portion 21 engages a second rotary guide 27 that is secured to a shaft 28 journaled in the frame 25. The longitudinal axes of the guides 23 and 27 are parallel and spaced from one another with the guide 27 above the guide 23 so that the path of the tube 19 may vary from path 26 to path 29 as the length of the tube 19 varies from taut to slack between its continuous and intermittent advancing means. As shown in FIGURE 4, the guides are rotatable wheels, which preferably rotate freely but may be driven. If driven, guide 23 would be driven intermittently to accommodate the intermittent motion of the contiguous portion of the tube 19. Guides 23 and 27 also substantially reverse the direction of the path of travel of the tube 19 as it progresses from the welding electrode to an indexing and severing mechanism generally designated 30, also mounted on frame 25, which will be explained with particularity hereafter.

The indexing and severing mechanism 30 is shown in greater detail in FIGURES 5, 6 and 7. Opposed indexing wheels 32 and 33 grip the advancing tube 19 by means of the concave or sheave-like contours of segments 34 and 35 which, substantially simultaneously, engage the tube 19 on opposite sides thereof and move the tube a predetermined distance with each revolution of the wheels. The remaining peripheral segments of the indexing wheels 32 and 33 are spaced from the path of the tube 19 so as to avoid contact with the tube. Indexing wheels 32 and 33 are rotatably mounted, respectively, on substantially parallel shafts 36 and 37.

The upper end of shaft 36 is driven in a clockwise direction (FIGURE 6) by means of a suitable power source which is not shown. Secured to the lower end of shaft 36 is a bevel gear 40 which meshes with a bevel gear 42 fixedly mounted on shaft 44 that is journaled in the frame 25 whose axis is normal to the axis of shaft 36. At the other end of shaft 44 is keyed bevel gear 46 which in turn meshes with bevel gear 47 secured to the lower end of shaft 37. Thus indexing wheel 33 is driven by the described gear-shaft train in a direction opposite to that of indexing wheel 32. Accordingly, the sheave-like contoured segments 34 and 35 of the indexing wheels grip the advancing tube 19 in unison and impart to the tube an intermittent advancing motion.

Upon disengagement from the sheave-like contours segments 34 and 35, the foremost partially severed can body 20*a* enters an angularly positioned gauging stop 48 disposed adjacent to and forwardly of the segments. This positions the body 20*a* at an angle to the next adjacent tube length 20*b*, thus opening a V-shaped gap 49 between the foremost tube body 20*a* and the next adjacent body, 20*b*. An unslit portion 21*a* is at the apex of the V-shaped gap 49 and still connects body 20*a* to body 20*b*.

Extending across one end of the frame 25 adjacent the indexing wheels 32 and 33 is a bracket 50 secured to the frame by any suitable means such as machine screws 51. Towards its center, the bracket 50 has a downwardly extending arm 50*a* terminating in a cup-like recess 53 in which is mounted an expansion spring 54, the opposite end of which bears against a depending end wall 48*a* of the stop 48.

The spring 54 biases the stop 48 about a pivot pin 55, located at the upper end of wall 48*a*, into its normal downwardly inclined relationship with the tube 19. Integral with and extending inwardly from the arm 50*a* is a rigid arm 50*b* terminating in a tip 50*c* which bears against an upper wall 48*b* of the stop 48 and limits the inclination of the stop 48.

Once the foremost partially slit body 20*a* is brought into position within stop 48 by the indexing wheels 32 and 33, the gear-shaft train operating the wheels 32 and 33, hereinbefore described, also activates a severing mechanism in timed relationship with the wheels 32 and 33. Secured to the upper end of shaft 37, which also has indexing wheel 33 mounted thereto, is bevel gear 56. Gear 56 meshes with the bevel gear 57 which is rotatably secured on shaft 58, whose axis is parallel to the axis of the body 20*b*.

Rotatably attached to the other end of shaft 58 is a cutting knife 59 which revolves with the shaft 58 in timed relationship to the advance of the tube 19. A cutting edge 60 enters the V-gap 49 when the body 20*a* comes to a momentary stop within the gauge 48 and severs the body 20*a* from the tube 19 at the unslit portion 21*a* without leaving slivers attached to either of the adjacent bodies.

Integral with knife 59 is a boss 63, having secured to it by means of bolt 64, a hard member 65 which engages a hardened portion 68 of the stop wall 48*b* immediately after the unslit portion 21*a* has been cut by the rotating knife 59.

Upon being engaged by the member 65 the stop 48 is pivoted downward, removing the then severed body 20*a* from the remainder of the tube 19. During the downward movement of the stop 48, the spring 54 is compressed. Upon release of the severed body 20*a* from the stop 48, the spring 54 expands to return the stop 48 to its normal position for receiving the next body 20*b*, which is the foremost end of tube 19.

After separating from the stop 48 the severed can body 20*a* is received by a chute 84. The chute 84 is mounted on the frame 25 by means of a bracket 86 and securing bolts 88. Chute 84 then guides the severed can body 20*a* to a suitable storage or finishing area, which is not shown. It is readily apparent that many methods may be used to collect the severed can bodies, the above description being for the purpose of clarity and continuity.

It is thought that the invention and many of its attend-

ant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts and that changes may be made in the steps of the methods described and their order of accomplishment without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A method of separating predetermined lengths from a continuous tube of flexible material, which tube is weakened along a line extending transversely around the greater portion of its circumference at spaced intervals corresponding to said predetermined lengths but is integral and unweakened along a longitudinally extending portion thereof comprising, passing said tube along a path of travel including: (1) a straight-line path wherein said tube moves continuously and said transverse weakened lines remain closed; (2) a lateral path spaced from said straight-line path with said unweakened portion on the inside thereof wherein said tube moves intermittently and a V-shaped space is opened between the foremost predetermined length and the remainder of said tube, the unweakened portion at the apex of said space remaining stationary for a time interval due to the intermittent movement of said tube in said lateral path; and (3) a path at an angle to and between said straight line and lateral paths variable within limits wherein the continuous movement of said straight-line path changes to the intermittent motion of said lateral path, inserting a cutting element into said space and severing said unweakened portion and removing said element from said lateral path while said unweakened portion is stationary, and separating the completely severed length from said tube.

2. The method set forth in claim 1 wherein the tube traversing said variable path is alternately slack and taut due to the change from continuous to intermittent movement.

3. The method set forth in claim 1 wherein said tube in traversing said path of travel, extends substantially horizontally in said straight line path, around a first arcuate guide, generally forwardly and upwardly in said variable path, around a second arcuate guide in a direction substantially opposite that around said first guide, rearwardly and substantially horizontally, and rearwardly and downwardly in said lateral path.

4. The method set forth in claim 3 wherein the unweakened portion of said tube engages a portion of the periphery of said first and second arcuate guides.

5. A method of separating predetermined lengths from a continous tube, which tube is made by forming a continuously moving strip of flexible material slit at spaced intervals partially across its width but unslit at its margins into tubular shape and continuously bonding the unslit margins together to produce a continuous tube slit transversely around the greater portion of its circumference at spaced intervals corresponding to said predetermined lengths and unslit along a longitudinally extending portion thereof comprising, passing the just-formed portion of the tube with continuous motion along a straight-line path of travel with said unslit portion on one side thereof, passing the forward end of said tube with intermittent motion along a path of travel spaced from said straight-line path, providing slack in the portion of said tube between said continuously moving tube portion and said intermittently moving tube portion to enable the motion of said tube to change from continuous to intermittent, positioning the foremost predetermined length at an angle to the remainder of said forward end while said forward end is in motion to open a V-shaped space between said foremost length and said remainder of said forward end with an unslit portion of said tube at the apex of said space, inserting a cutting element into said space and severing said unslit portion at the apex thereof while said foremost length and forward end are at rest, and separating said severed length from said tube.

6. An apparatus for separating a predetermined length from a continuous tube of flexible material, which tube is weakened transversely around the greater portion of its circumference at spaced intervals corresponding to said predetermined lengths and unweakened along a longitudinally extending portion thereof comprising, means for continuously conveying said tube along a straight-line path of travel, guide means disposed adjacent said straight-line path with a portion of its perimeter engaging the continuous unweakened portion of said tube, said guide means adapted to open a V-shaped space between each passing predetermined length and to guide said tube into a path of travel having a direction different from said straight-line path, indexing means spaced from said guide means for engaging said tube adjacent its forward end to move said forward end in timed intermittent motion in a forward direction, means adjacent said indexing means for positioning the foremost predetermined length of said tube at an angle to the next adjacent tube length whereby a V-shaped space is opened between said lengths with an unslit portion at the apex of said space, severing means adjacent said last mentioned means and said indexing means operating in timed relation with said indexing means to enter said V-shaped space during the stopped portion of said intermittent motion and to sever the unslit portion at the apex thereof, and means to separate the severed predetermined length from the remainder of said tube.

7. An apparatus for separating a predetermined length from a continuous tube of flexible material, which tube is slit transversely around the greater portion of its circumference at spaced intervals corresponding to said predetermined lengths and unslit along a longitudinally extending portion thereof comprising, means for continuously conveying said tube along a straight-line path of travel, a first guide means disposed adjacent said straight-line path with a portion of its perimeter engaging the contiguous unslit portion of said tube, said first guide means adapted to guide said tube into a path of travel extending laterally from said straight line path, a second guide means disposed adjacent said lateral path of travel with a portion of its perimeter engaging the contiguous unslit portion of said tube, the longitudinal axes of said first and second guides being parallel to and spaced from one another, said second guide means adapted to guide said tube into a path of travel extending at an angle to said lateral path, indexing means disposed adjacent said last mentioned path of travel and spaced from said second guide means for engaging said tube adjacent its forward end to move said forward end in timed intermittent motion in a forward direction, means adjacent said indexing means for positioning the foremost predetermined length of said tube at an angle to the next adjacent tube length whereby a V-shaped space is opened between said lengths with an unslit portion at the apex of said space, severing means disposed between said last mentioned means and said indexing means operating in timed relation with said indexing means to enter said V-shaped space during the stopped portion of said intermittent motion and to sever the unslit portion at the apex thereof, and means to separate the severed predetermined length from the remainder of said tube.

8. The apparatus set forth in claim 7 wherein said first and second guide means are freely rotatable wheels adapted to permit the length of tube extending between said wheels to be alternately slack and taut due to the change in motion of said tube from continuous to intermittent.

9. The apparatus set forth in claim 7 wherein said indexing means is a pair of wheels disposed one on each side of said tube adjacent its forward end rotating in unison and in opposite directions, a portion of the periphery of said wheels having a sheave-like contour for gripping

said tube therebetween to move said tube a predetermined distance during each complete revolution of said wheels, and the remaining portion of the periphery of said wheels being spaced from said tube so as to be non-contacting therewith.

10. An apparatus set forth in claim 7 wherein said severing means comprises a knife rotating on a shaft substantially parallel to said last mentioned path of travel.

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