March 6, 1956 E. B. ROBINSON 2,737,091

METHOD OF MAKING HELICALLY WOUND CONTAINERS

Filed Nov. 25, 1952 2 Sheets-Sheet 1

FIG. 1

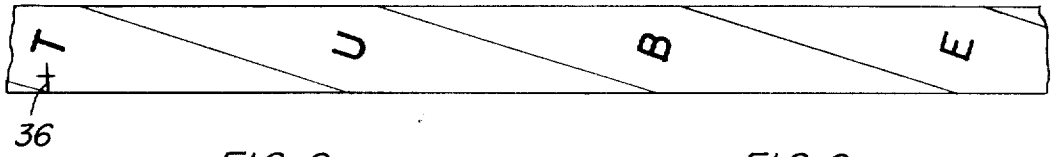


FIG. 2

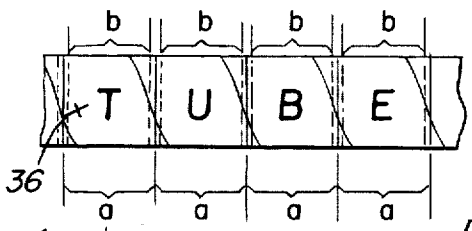


FIG. 6

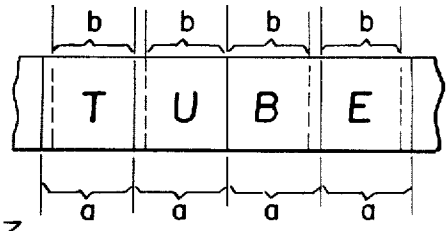


FIG. 3

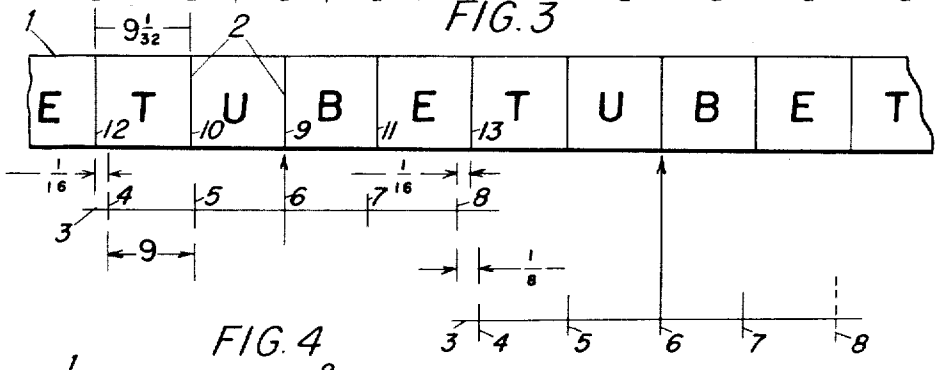


FIG. 4

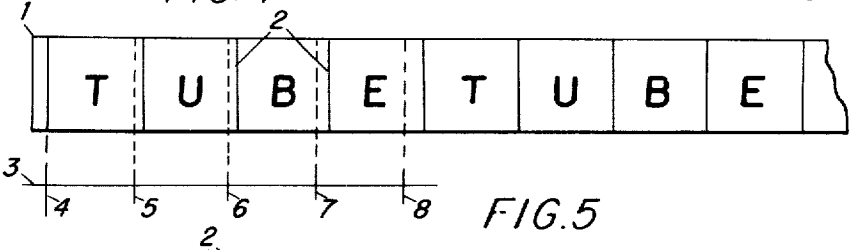
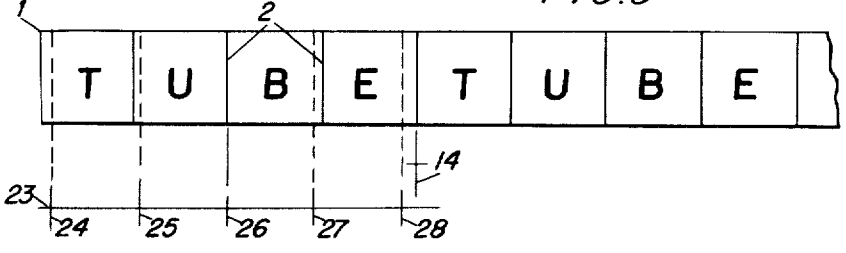


FIG. 5



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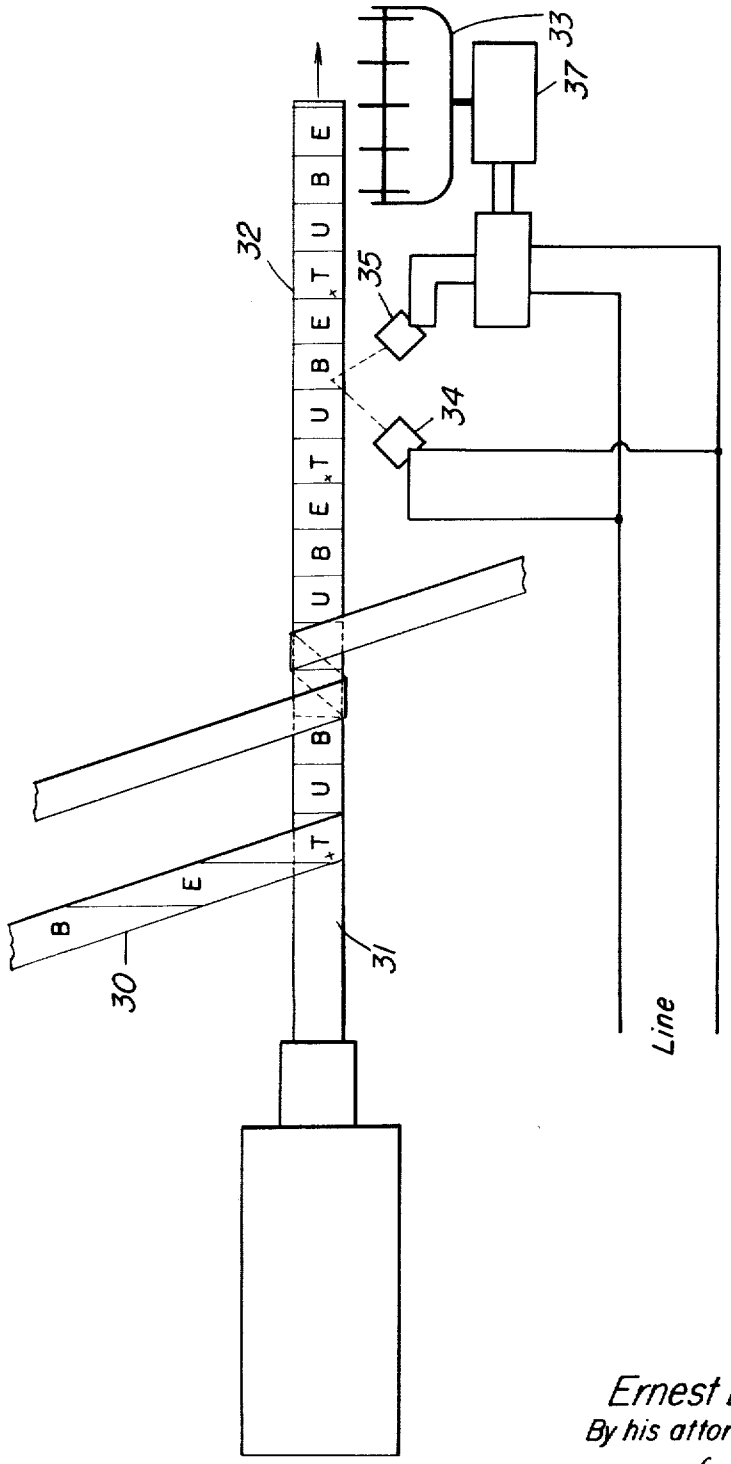


FIG. 7

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United States Patent Office

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METHOD OF MAKING HELICALLY WOUND CONTAINERS

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13 Claims. (Cl. 93—94)

This invention is for improvements in or relating to cylindrical cartons or containers formed by helical winding, that is to say, lengths of tubing appropriate to form the body of a container and cut from tubing suitably formed by helically wound strip paper, cardboard, cellulose material, metal foil, or the like.

More particularly, the invention relates to a method for producing helically wound containers each having a unitary pattern printed thereon.

In order that the invention may be more clearly understood, the following definitions are offered for terms which will be used in the specification and claims.

The term "unitary pattern" means a pattern, i. e., a significant grouping of lines, letters or symbols such as might be used to decorate a container, to which can be assigned a beginning and an end, the material lying within said unitary pattern being that nominally equal in wound length to one container.

The term "pattern section' means a length of tubing containing one wound unitary pattern together with any surplus space as may be added.

The term "frontier" means a line where one pattern section abuts against the next pattern section.

In the method of making helically wound containers having unitary patterns described in my copending application Serial No. 726,467, filed February 5, 1947, now Patent No. 2,623,445, tubing is wound having a series of such unitary patterns thereon, the unitary patterns occurring in groups, separated by a space known as "planned trim."

According to that method, lengths of the tubing, or "bites," are severed by cutting and the individual containers are cut apart either simultaneously or in a subsequent operation. The planned trim space is made long enough to account for all winding and cutting variations of the pattern in the bite and prevents encroachment of the cuts into the unitary pattern.

My British patents 653,613 and 653,616, and my said copending U. S. application Serial No. 726,467, now Patent No. 2,623,445, make it clear that the provision of planned trim spacing is one of the necessary requirements to ensure that pattern-bearing containers bear an unmutilated unitary pattern. Prior to this invention the production of unitary pattern-bearing containers without the provision of trim spacing results either in (*a*) the production of such containers bearing a mutilated pattern, or (*b*) the wasting of one or more containers to take the place of planned trim spacing. The first method is commercially undesirable, and the second is both commercially undesirable and uneconomical except for extremely shallow containers.

The present invention provides a method of producing unitary pattern-bearing containers without the necessity of periodic planned trim spacing by using, for example, "parcelled-out" planned trim.

The present invention comprises a method for producing containers having unitary patterns thereon in which a strip having the unitary patterns and control features

thereon is wound helically to form tubing comprising a series of pattern sections, each section, for example, including a unitary pattern and being nominally somewhat longer than necessary for the desired container by an amount equal to the maximum probable winding and cutting errors in each container length. Thus, the trim necessary to compensate for winding and cutting errors in one bite is parcelled out among the pattern sections in that bite. The tubing is moved axially as it is formed. One of the control features on the tubing is then detected and by this detection the severing or cutting up of a bite comprising a plurality of pattern sections is regulated. The bite may be divided into individual containers in which the unitary pattern is in substantial registry with the ends of the container either in subsequent operation or by a cutting conducted simultaneously with the severing. The cutting up or severing operation is regulated to be in predetermined relation to the unitary pattern so that generally at least one cutter makes its cut at or adjacent the line of division separating one pattern section from the next. This line of division, as mentioned above, is known as the "frontier" or "medial point." This frontier may or may not be a visible boundary between adjacent pattern sections.

In the method according to the invention, if a plurality of containers are cut from the tubing simultaneously, and if the winding machine is producing pattern sections of theoretically or nominally perfect length, only one cut will coincide with a frontier if there are an odd number of cutters. If there are an even number of cutters, two of them may be equally spaced from frontiers. The other cuts will depart from their frontiers by an amount determined by the difference in length between the pattern section and the desired container, and by the remoteness of the particular cutter from the cutter which is aligned with a frontier. This variation, is however, of such small proportion that it does not interfere with the commercial acceptability of the finished containers, and since each time the cutters are applied at least one is either in alignment with or a constant distance from a frontier, the departure or accumulated error does not accumulate from one bite to the next. By this means and cutting at frequent intervals it is possible to keep the effect of winding errors within commercial tolerance.

Moreover, if, as often happens, the pattern sections as wound are somewhat smaller than their nominal length, the unitary pattern will never have to be cut into when using the present invention.

It will be understood that the maximum probable error in a bite for any type of winding machine is readily ascertainable by observation and the length of the pattern section is then set accordingly.

The setting in motion of one of the plurality of cutters when in alignment with a frontier is preferably accomplished by means responsive to a control feature on the strip material, as set forth in my Patent No. 2,623,445, above mentioned.

A great advantage of the present invention is that by dispensing with periodic planned trim, any convenient number of unitary patterns can be put on a cylinder or plate without the necessity of the number bearing a direct relationship to the position of the periodic pre-planned trim spacing. This means that smaller cylinders can be used.

Another advantage is that it enables a cutting up machine, whether attached to the winder or used as a separate operation, to be filled near to its maximum capacity. This is due to the fact that the length of the "stick" is not predetermined by the printing cylinder circumference.

This is in contrast to the method where periodic trim spacing is provided. In that prior method the lengths of tubing presented to the cutter or cutters had to be equal

to or a multiple of the lengths of tube between any two periodic trim spacings, and therefore had to include a multiple of the given number of designs appearing between two trim spacings. With periodic trim spacing eliminated and when the pattern sections are identical, any convenient number of designs can appear on the printing cylinder, and any convenient number can be cut up by the cutters.

In a modification of the invention, a stick or bite containing a plurality of pattern sections is cut from the tubing by a cut effected at or in the region of the medial point or frontier between two adjacent pattern sections, and this length is subsequently sub-divided into containers by the simultaneous application of a plurality of cutters.

In a further modification of the invention, at least three simultaneously-operating cutters are employed whereby at least two rims are produced simultaneously. In this case an intermediate one of these cutters is applied substantially at the median point or frontier between two adjacent pattern sections and the others are somewhat out of register with the appropriate frontier between other pattern sections.

The locations of the cuts effected in the tubing must be controlled, automatically or otherwise, by reference to control features on the tubing. This is done in order that the locations of the cuts may be confined substantially to the required regions of the tubing, it being appreciated that owing to an aggregation of winding and cutting errors there will be a tendency for the cuts to depart (e. g. to creep) from the required regions. The correction of the locations of the cuts may be made each time a cut is made in the tubing, or at other fixed intervals (e. g. after a specified number of cuts) or only when the deviation reaches or approaches that which is commercially undesirable. By "control features" I mean any visual or physical variation on the strip which can be detected by any person or by any devices such, for example, as shown and described in my said patent No. 2,623,445.

The invention also provides a method of producing unitary pattern-bearing containers of predetermined length in which a plurality of cutters are used, an end cutter cutting at one end of a pattern section and the remaining cutters cutting at points displaced from their corresponding pattern section frontiers, in the direction of the first cutter, thereby to cut off one or more containers and a certain amount of trim waste.

The foregoing and other features of the invention are incorporated in the construction which is hereinafter described, as specific embodiments, with reference to the accompanying drawings.

In the drawings:

Figure 1 is a diagram of a printed strip such as can be used in carrying out my invention.

Figure 2 is a schematic view of a piece of helically wound tubing wound from a strip such as shown in Fig. 1.

Figure 3 is a schematic view illustrating a plurality of pattern sections in the tubing such as shown in Fig. 2, and how they can be cut according to the invention by a plurality of cutters in one operation.

Figure 4 is a schematic view illustrating an alternate method of forming containers according to the invention wherein the end cut of a plurality of cuts conforms with a frontier.

Figure 5 is a schematic view illustrating another alternate embodiment of the invention wherein a group of pattern sections is severed from tubing by a single cut made at a frontier and is subsequently divided into containers in another operation.

Figure 6 is a variation of Fig. 2 showing pattern sections in which the unitary patterns are displaced from the middle of the pattern sections.

Figure 7 is a schematic view of one form of apparatus for carrying out the invention.

In one manner of carrying the invention into effect, shown in Fig. 7, strip material **30** is wound helically on a mandrel **31** substantially in the manner described in the specification of my said Patent No. 2,623,445, to form tubing **32**, and there is provided a plurality or gang of cutters **33** which traverse to and fro axially of the being-formed tubing. During the traverse, which is at the same speed as that of the being-formed tubing, the gang of cutters **33** is moved laterally of the tubing to cut a plurality of containers off the being-formed tubing. The timing of this lateral movement may be carried out by means of a photoelectric cell **34**, which is sensitive to the degree of reflection of a light beam from lamp **35** by control feature **36** (Figs. 1, 2). The mechanism for moving cutters **33** is indicated generally as **37** in Fig. 7. The cutters are spaced apart a distance equal to the length required for each container. Thus, if the containers are to be 9" long the cutters are arranged to be 9" apart.

In accordance with the invention, the strip material has unitary patterns printed in succession thereon in the appropriate angle necessary to form the desired effect on the finished container and referred to in said Patent No. 2,623,445 (see Fig. 1). The arrangement of each unitary pattern is such that when the tubing is formed, the patterns are presented in pattern sections arranged in succession along the tubing with a pitch lengthwise of the tubing nominally slightly greater than the length required for a container. In the particular example illustrated in Fig. 2, the approximate wound length of each pattern section *a* is 9 1/32". The unitary patterns are indicated at *b*.

Figure 3 shows a length of tubing **1** having lines **2** equally spaced apart 9 1/32" to indicate the pattern sections in the tubing. For the sake of convenience the unitary patterns in a bite or stick are represented by the letters T, U, B, E. The rectangles in Fig. 3, each carrying one of these letters and each shown divided from the next by a solid line across the tubing, represent pattern sections. Each pattern section occupies the full area and length of such rectangle, but any lettering or other special parts of the unitary pattern, the defacing of which would render the cartons unacceptable commercially, will preferably be kept at such a distance from the end of a unitary pattern so as to avoid such defacing. In the example referred to this will be slightly more than 1/16", as will readily be seen from Fig. 3.

The frontiers or boundaries are represented by the aforesaid lines, and while in Fig. 3 these lines are shown as being disposed midway between successive unitary patterns, it will be appreciated that the unitary patterns need not be placed in the exact center of the pattern section. An offset disposition of unitary patterns is shown in Fig. 6 where *a* represents the pattern sections and *b* the unitary patterns.

A plurality or gang of cutters is indicated at **3** in Fig. 3, and the number of cutters employed is one in excess of the number of containers which it is required to cut at any one time, i. e., at one bite. Thus in the particular example under discussion, it is desired to cut four containers at a time (e. g., those bearing the letters T, U, B, E) and for this purpose there are five cutters **4, 5, 6, 7** and **8** which, for the present example, are spaced 9" apart for cutting containers 9" long.

In operation, the plurality or gang of cutters **3** is arranged to cut the tubing at such a location that the central cutter **6** is in line with the junction **9** between the innermost pattern section U and B (i. e., at the medial point or frontier between these pattern sections), and because the length of the pattern sections is 9 1/32" and the spacing of the cutters is 9", it therefore follows that the cutters **5** and **7** will register with the tubing at locations spaced by 1/32" from the junctions **10** and **11**, respectively, between the outer pattern units T, U, and B, E, respectively, the spacings being in a direction towards the central cutter **6** or junction **9** between the pattern sections U and B. Furthermore the cutters **4** and **8** will register with the tubing at locations spaced, this time by 1/16" from the frontiers **12**

and 13, respectively, between the end pattern sections E, T, respectively, as shown. The spacing again is in a direction towards the central cutter 6 or frontier 9 between the pattern sections U, B. It thus follows that when the gang of cutters is caused to move laterally into the tubing to cut it into container lengths, the container lengths will be 9" as determined by the spacing of the cutters, but the pattern sections thereon will not be entirely complete; more specifically, the containers U and B will each be short of part of a pattern section to the total extent of 1/32" at their outer ends and the containers T and E will each be short of part of a pattern section by a total of 1/16" at their outer ends and will include part of an additional pattern section (from sections U, B) at their inner ends to the extent of 1/32".

The operation of cutting the next part of the tubing is indicated at the right in Fig. 3 in the drawings, from which it will be seen that the said five cutters 4, 5, 6, 7, and 8 are caused to register with the next four pattern sections in the tubing (again marked T, U, B, E) in such a manner that the central cutter 6 register with the frontier between the sections U and B and so on as previously described for the first set of sections T, U, B, E. In consequence of this the containers produced from the second batch of sections T, U, B, E will be precisely the same in length and lay-out as the first batch previously described. However, by virtue of the fact that the overall length of each batch of sections T, U, B, E is greater than the distance between the end cutters 4 and 8, a short surplus length of tubing will be cut off between the sections E and T (centrally disposed in Fig. 3) and wasted. The length of this surplus tubing will be the sum of the two amount of 1/16" (totaling 1/8") by which the containers E and T are short of the complete pattern sections at those ends thereof which are adjacent in the tubing.

It will be appreciated that when an intermediate cutter, such as 6 in Fig. 3 is aligned with a frontier, the displacement of the end cutters (4 and 8 in Fig. 3) from their corresponding frontiers is minimized. However, it is to be understood that instead of the cutters being arranged so that the central cutter 6 registers with the frontier between the sections U and B, the arrangement may be such that any of the other cutters either registers with or is a constant distance from the frontier between the appropriate pattern sections. An example of this is shown in Fig. 4 wherein the cutter 4 registers with the junction between pattern sections E and T, and in this case the extent of non-registry of the pattern sections with the containers will increase progressively along the tubing from the section T to the section E.

In the modified method shown in Fig. 5, the tubing is cut by a single cutter 14 on the machine on which the tubing is wound at each frontier between the pattern sections E and T, to cut off sticks each comprising four pattern sections T, U, B, and E. Each stick is then transferred to a cutting-up machine which includes a mandrel (not shown) and a plurality of cutters 24, 25, 26, 27 28, spaced as before described, i. e., in this instance 9" apart. After threading the stick onto the mandrel, the cutters are first disposed with the central cutter registering with the frontier between the pattern sections U and B. The cutters are then caused to cut the tubing into containers, and trim off a surplus length of tubing at each end. Thus each container is of standard length. Any other intermediate cutter (instead of the central cutter) may be registered with its appropriate medial point or frontier. It is to be understood that any of the modifications herein referred to with respect to the use of a plurality or gang of cutters in the winding machine, may be put into practice by the use of a single cutter and the plurality or gang of cutters in the separate cutting up machine, just referred to.

The above methods may be carried out by the employment of manually and/or automatically operated means, e. g., in suitable association with the appropriate methods and apparatus disclosed in my copending U. S. applications Serial Nos. 726,467, now Patent No. 2,623,445; and 11,955, filed February 28, 1948, and in my British Patents 653,613, 653,616 or 661,851. For example the registration of the appropriate cutter or cutters with the appropriate junctions between pattern units (or medial points or frontiers) on the being-formed tubing may be effected by, for example, a light sensitive cell and associated mechanism, or by any of the other mechanisms described in the above applications and patents. These cooperate with control features in the pattern strip material or on the tubing as it is formed. Adjustment of the location of the cuts in the tubing may be effected through the medium of apparatus controlled by an operator, who observes the location of the cuts (e. g. in relation to control features) and makes appropriate adjustment when required. Thus, for example, there may be employed apparatus according to Figure 12 of the British Patent No. 653,613. Alternatively, in a machine in which each cut is initiated by the end of the tubing making contact with a target, means may be provided under the control of the operator for adjusting the position of the target, or for adjusting the distance between the target and the cutter or cutters. When the gang cutting operation is performed on a separate machine, the apparatus according to British Patent No. 653,613, is particularly suitable whereby the cutter is controlled to operate with a pause between each operation. When a plurality of cutters is employed on the winding machine itself, the latter may include apparatus with a pause between cutting operations or apparatus according to my co-pending U. S. application Serial No. 11,955, now Patent No. 2,623,443, in which the cutters have a continuous motion and the control is by varying the speed relationship between tubing and cutting.

The control features may be disposed at any appropriate region in the width of the strip, and if detection is carried out on the strip as the latter runs to the mandrel, may be disposed in a margin of the strip that is underlapped in the winding operation so as to be concealed.

What I claim is:

1. A method of producing cylindical containers of predetermined length each having a helically-wound unitary pattern thereon approximately equal to the length of the container, comprising the steps of providing strip material having unitary patterns and control features thereon and including surplus trim material parcelled out among said unitary patterns, helically winding said strip material into tubing, said tubing comprising a series of pattern selections each including one unitary pattern and each nominally somewhat longer than one container simultaneously moving the tubing axially; detecting one of said control features, an regulating the severing of a bite of tubing thereby in predetermined relation to the unitary pattern, said bite including a plurality of pattern sections; and also cutting up the bite to form a plurality of containers of predetermined length, whereby the unitary pattern on each container in the bite is in substantial registry with the ends of the container and the errors of length of the wound pattern are abated in each bite.

2. A method of producing cyclindrical containers of predetermined length each having a helically-wound unitary pattern thereon approximately equal to the length of the container, comprising the steps of providing strip material having unitary patterns and control features thereon and including surplus trim material parcelled out among said unitary patterns, helically winding said strip material into tubing, said tubing comprising a series of pattern sections each including one unitary pattern and each nominally somewhat longer than one container because of the maximum probable pattern-winding error accumulated in a bite of tubing being parcelled out among the pattern sections of the bite, simultaneously moving the tubing axially; detecting one of said control features and regulating thereby the severing of a bite of tubing

in predetermined relation to a frontier dividing one pattern section from an adjacent pattern section, said bite including a plurality of pattern sections; and also cutting up the bite to form a plurality of containers of predetermined length; whereby the unitary pattern of each container in the bite is in substantial registry with the ends of the container and the errors of length of the wound pattern are abated in each bite.

3. A method of producing cylindrical containers of predetermined length each having a helically-wound unitary pattern thereon approximately equal to the length of the container, comprising the steps of providing strip material having unitary patterns and control features thereon and including surplus trim material parcelled out among said unitary patterns, helically winding said strip material into tubing, said tubing comprising a series of pattern sections each including one unitary pattern and each nominally somewhat longer than one container simultaneously moving the tubing axially; detecting one of said control features, and regulating thereby the simultaneous severing and cutting up of a bite of tubing including a plurality of pattern sections, in predetermined relation to the unitary pattern to form a plurality of containers of predetermined length, whereby the unitary pattern on each container in the bite is in substantial registry with the ends of the container and the errors of length of the wound pattern are abated in each bite.

4. A method as claimed in claim 3 wherein cuts are made in severing and cutting up the bite and at least one of said cuts is positioned substantially at a pattern section frontier.

5. A method as claimed in claim 4 wherein an intermediate cut made in cutting up said bite is positioned at a pattern section frontier; whereby the nominal departure of other cuts from their corresponding frontiers is minimized.

6. A method as claimed in claim 3 wherein cuts are made in severing and cutting up the bite, the cut made in severing the bite from the tubing is positioned at a pattern section frontier and the cuts made in cutting up said bite are nominally displaced from their corresponding pattern section frontiers toward the cut made in severing said bite.

7. A method of producing cylindrical containers of predetermined length each having a helically-wound unitary pattern thereon approximately equal to the length of the container, comprising the steps of providing strip material having unitary patterns and control features thereon and including surplus trim material parcelled out among said unitary patterns, helically winding said strip material into tubing, said tubing comprising a series of pattern sections each including one unitary pattern and each nominally somewhat longer than one container simultaneously moving the tubing axially; detecting one of said control features, and regulating thereby the application of a plurality of cutters spaced apart by the length of one container, to said tubing to sever and cut up a bite of tubing including a plurality of pattern sections and form a plurality of containers of predetermined length, one of said cutters being applied at a pattern section frontier, whereby the unitary pattern of each container in the bite is in substantial registry with the ends of the container and the errors of length of the wound pattern are abated in each bite.

8. A method as claimed in claim 7 wherein the cutters are arranged in a row and an intermediate cutter is applied to a pattern section frontier, thereby minimizing the departure of other cutters from their corresponding pattern section frontiers.

9. A method as claimed in claim 8 wherein there are an odd number of cutters for cutting off an even number of pattern sections and the central cutter is aligned with a pattern section frontier.

10. A method as clamed in claim 7 wherein the cutters are arranged in a row and an end cutter is aligned with a pattern section frontier.

11. A method of producing cylindrical containers of predetermined length each having a helically-wound unitary pattern thereon approximately equal to the length of the container, comprising the steps of providing strip material having unitary patterns and control features thereon and including surplus trim material parcelled out among said unitary patterns, helically winding said strip material into tubing, said tubing comprising a series of pattern sections each including one unitary pattern and each nominally somewhat longer than one container, simultaneously moving the tubing axially; detecting one of said control features, and regulating thereby the severing of a bite of tubing substantially at a pattern section frontier, said bite including a plurailty of pattern sections; and subsequently cutting up the bite to form a plurality of containers of predetermined length, whereby the unitary pattern of each container in the bite is in substantial registry with the ends of the container and the errors of length of the wound pattern are abated in each bite.

12. A method as claimed in claim 7 wherein the cutting up is carried out by applying a series of cutters simultaneously to the cut-off bite, at least one of said cutters being in substantial registry with a pattern section frontier.

13. A method as claimed in claim 8 wherein the cutters are separated by a distance equal to one pattern length and the number of cutters in the series is one more than the number of pattern sections of the bite.

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