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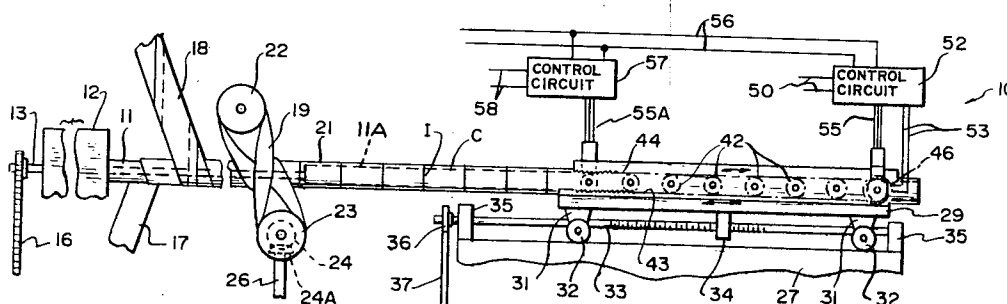
[56] **References Cited**

3,150,575	9/1964	Couzens et al.....	93/80
3,158,074	11/1964	Brigham	93/80
3,220,320	11/1965	Brigham	93/80

[57] **ABSTRACT**

Each of the cutters is mounted on a carriage movable along a pinion axis indexed to an error-distributing position, the pinion moving between a pair of racks engaging a group of such error-correcting pinions. The latter are each spaced a distance corresponding to the proper length of the container body plus or minus the error therein. The pitch diameter of the pinions varies from a minimum to a maximum according to the error accumulating in the formation of the stick.

5 Claims, 5 Drawing Figures



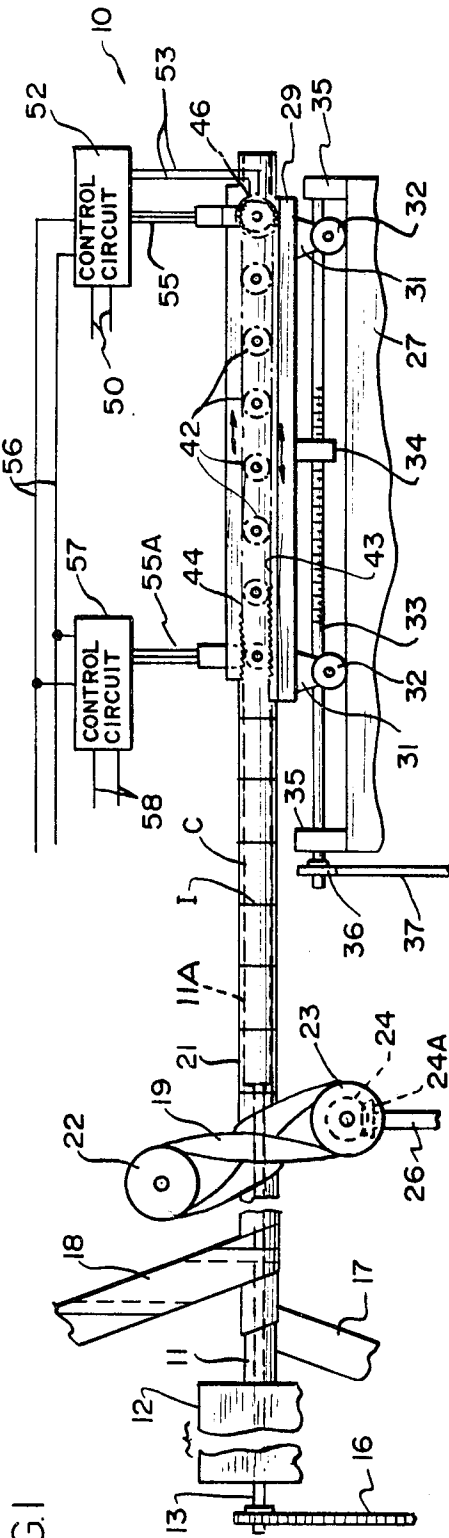


FIG. 1

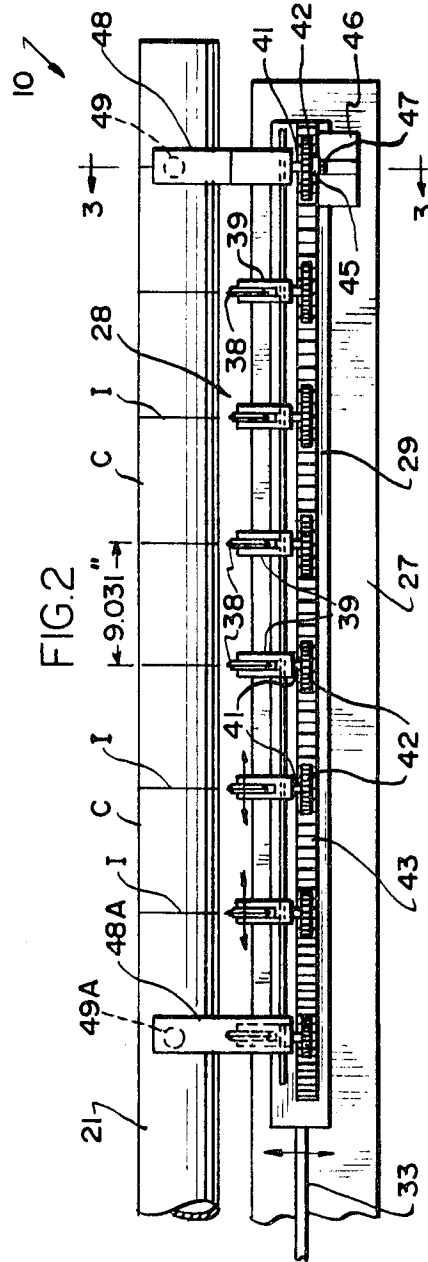


FIG. 2

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FIG. 3

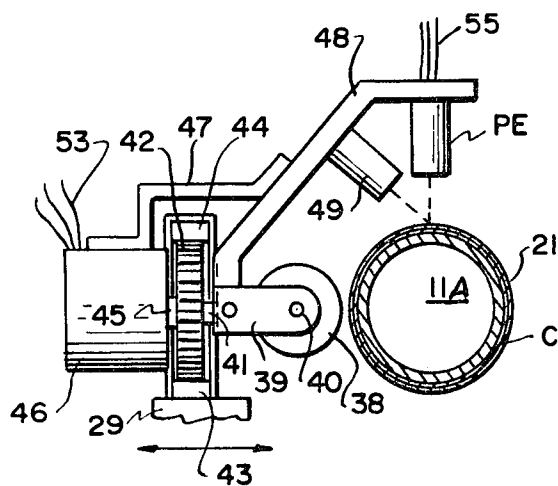


FIG. 4

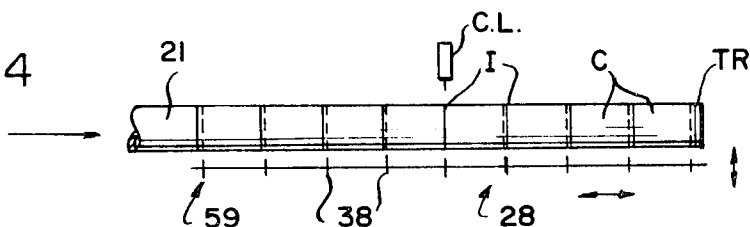
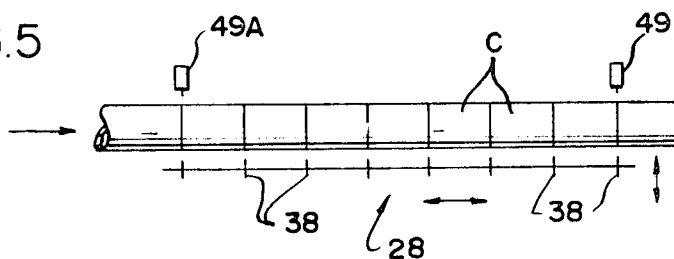


FIG. 5



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APPARATUS FOR DISTRIBUTING ERRORS IN THE FORMATION OF HELICALLY WOUND CONTAINER BODIES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to apparatus for forming a container body by helically winding at least one lamina on a fixed mandrel and moving a "stick" thus formed longitudinally of such mandrel. The stick is later moved on to a rotating mandrel which serves as an anvil where the stick is cut into discrete lengths according to the invention. The wound lamina has repetitive indicia thereon marking the beginning and end of a plurality of the discrete cylinders to be cut from the stick. The apparatus according to present invention enables the error in the winding to be distributed properly into each cylinder after a number have been formed in the winding operation.

2. The Prior Art

Apparatus for distributing errors of the kind mentioned above is best exemplified in Brigham U.S. Pat. No. 3,158,074 in Class 93; Subclass 80. That patent shows a pantograph arrangement for distributing the error.

SUMMARY OF THE INVENTION

The apparatus according to the present invention constitutes an improvement over the prior art in that the use of a many-jointed linkage mechanism is avoided.

THE DRAWINGS

FIG. 1 is a schematic elevational view of a machine for forming helically wound can bodies having the improvements according to the present invention embodied therein;

FIG. 2 is a plan view, to an enlarged scale, of a portion of the machine seen in FIG. 1, and showing a cutter array for cutting a "stick" of container bodies into discrete lengths;

FIG. 3 is a side elevational view looking in the direction of the arrows 3—3 of FIG. 2;

FIG. 4 is a schematic view of a "stick" of containers trimmed to length in accordance with what is known in the prior art as the "planned trimmed method"; and

FIG. 5 is a view similar to FIG. 4 showing the manner in which the container bodies are cut to proper length by the structure according to the present invention.

The apparatus for distributing errors in the formation of helically wound container bodies is denoted generally by the reference numeral 10 and includes a fixed arbor or mandrel 11.

After the wound container bodies are formed in the fixed mandrel they move on to a rotating mandrel 11A turning with a driving shaft 13 nesting within fixed mandrel 11. A driving sprocket 14 is fixed upon the shaft 13 and is driven by a chain 16. One or more base strips of fibrous material such as paper 17 may be helically wound on the mandrel 11, and a pattern strip 18 is wound upon the tube formed by the winding of the base strips 17. The pattern strip 18 is fed on to the base tube in the same spiral angle or pitch as the base tube, being normally offset with respect to the seam formed on the outside of the base tube. The application of the pattern strip 18 to the base tube produces a succession of patterns upon the outside of the tube.

A crossbelt 19 is trained about spaced pulleys 22 and 23 and turns or rotates the tube 21 on the mandrel 11, and advances the formed tube forwardly along the rotating mandrel 11A to the right as seen in FIG. 1. Pulley 24 has a bevel gear 24 fixed thereto, meshing with a bevel gear 24A fixed on a driving shaft 26.

It may be noted that the rotation of mandrel 11A and the driving of the pulleys 22 and 23 is effected by driving motors, not shown, and well known in the prior art, and they are accordingly not shown herein.

In the forming of the tube 21 and the winding the pattern strip 18 therearound a plurality of regularly spaced indicia I

are formed between adjacent container body lengths C. It may also be noted that the wrapping of the successive layers about mandrels 11 and 11A may be concomitant with gluing mechanisms well known in the prior art. They are accordingly not described herein.

Desirably, the length of each container bodies C is a constant, but by reason of variations in printing and variations in temperature and humidity of the ambient in which the container bodies are being formed and variations in specification of the strips being wound on the arbor 11, the length of each container body C may be greater or less than a desired amount. The error in the length of the can bodies C is cumulative as the "stick" moves along mandrel 11A.

It is to the proportioning of this error into each of the container bodies C that this invention is directed.

Accordingly, structure is provided for proportioning and distributing the total error in a stick into the container bodies C. To this end there is provided a fixed carriage 27 supporting an array of cutters 28. These are mounted on a flying carriage 29 having supports 31 with wheels 32 at the lower ends thereof for supporting the flying carriage 29 on the fixed carriage 27.

Structure is provided for moving the flying carriage 29 with respect to the fixed carriage 27, and to this end a lead screw 33 cooperates with a fixed nut secured to the underside of the flying carriage 29. The rotating lead screw 33 has a sprocket 36 fixed to one end thereof, and a sprocket chain 37 turns the lead screw 34 which is journaled in supports 35 at each end of the fixed carriage 27.

The cutters for cutting the "stick" into the discrete container bodies C each consists of a circular cutting knife 38 mounted in clevis 39 supporting an idler shaft 40 for the circular cutter 38. A stub shaft 41 extends from the base of each clevis 39 and has a pinion 42 rotatably supported thereon. The pinions 42 are adapted to rotate between a lower rack 43 formed as part of the flying carriage 29 and an upper rack 44.

The pitch diameters of the pinions 42 increase in viewing the same from the right to the left as seen in FIGS. 1 and 2, and the upper rack 44 therefor diverges slightly with respect to lower rack 43.

Extreme right-hand cutter 38 is arranged to sense the indicia I between the first and second container body C viewing the same from the right to left as seen in FIG. 2. The clevis 39 mounting the cutter 40 at such juncture between the first and second container bodies is best seen in FIG. 3. Clevis 39 has a bracket arm 48 extending upward therefrom which is in overlying relationship to the "stick" supported on the rotating mandrel 11A. Bracket arm 48 has a light source 49 secured thereto which causes a light beam emanating therefrom to impinge against the surface of the tube 21. The light is reflected therefrom into a photoelectric cell PE, the output of which is connected by leads 53 to a control circuit 52 connection to supply leads 56 to a source of power seen in FIG. 1.

The control circuit 52 has a double function, one being to energize a motor 46 turning a shaft 45 made fast to the pinion 42 associated therewith, said pinion being at the right end of the array 28 of the cutters 38. Motor 46 is braced in position by a bracket arm 47 secured at its ends to motor 46 and bracket arm 48.

The other function of the control circuit 52 is to energize a circuit including leads 50 to control the operation of the lead screw 33 controlling the movement of the flying carriage 29. The details of such control circuit and the control of flying carriage 29 are best illustrated in Brigham U.S. Pat. No. 3,158,074.

The energization of the motor 46 causes the pinion 42 driven thereby to move the right-hand-most cutter of the array 28 into a position of register with the indicia marked I between the first and second container bodies. The rotation of said pinion causes the upper rack 44 to move translatively through a distance which is twice the movement of the center of the shaft 45 and the pinion 42 thereon. This causes each of the successive pinions 42 at the ends of can bodies C from number

one to through number eight of the can bodies C to be in register with the indicia I and ready for subsequent movement to sever the stick into discrete container bodies.

Consider now an assumption that the maximum accumulative error in forming a "stick" of eight bodies to be 0.250 inch. That error divided by a total of eight bodies comprising the "stick" results in an error a length of each of the bodies equal to 0.031 inch. That error in each body must be accompanied by a movement of the center of each successive pinion by an amount equal to the position of the pinion times the error in each body. Thus, the error existing in the "stick" between container body three and container body four is equal 3 times 0.031 inch or 0.093 inch. Accordingly, each of the pinions must have its center translatable by an amount equal to the error in each container body times its position on the stick as measured from the free end of such stick. It will be apparent, it is believed, that the pitch diameter of each pinion must increase by an amount equal to twice the error existing at the particular body, which gives a movement to the corresponding pinion center equal to the error existing in such container body end.

It will be appreciated that the selected error for a stick of eight container bodies may be plus or minus such selected error and that the movement of the pinion center and corresponding cutter 38 carried thereat will be approximate only.

Structure is provided for ensuring that the operation of the array of cutters takes place only when a completed stick containing eight connected container bodies is ready for cutting. To this end a similar bracket 49A is mounted at the eighth of the array of the cutters 28, the leftmost one as seen in FIGS. 1 and 2. Bracket 48A has a light source 49A thereon, the light from which is reflected from the stick 21 into a photoelectric cell, not shown, connected by leads 55A into a control circuit 57 having a power supply connected by the leads 56 thereto. The output from the control circuit 57 is connected by output leads 58 to structure which controls the operation of the flying carriage 29. The output signal from control circuit 57 also cooperates with the control signal supplied by the output leads 50 from the control signal supplied by the output leads 50 from the control circuit 52. When the extreme right-hand cutter 44 of the array 28 is in register with the indicia I marking the point for severing the first container body from the second container body, and when the eighth cutter 38 of the array 28 is in alignment with the indicia I marking the point of severance between the eighth containers body and the first container body of a successive stick, all of the intervening cutters 38 and the pinions 42 for moving same are in a position of alignment with the indicia I marking the point of severance between adjacent container bodies.

Structure not shown, is provided for moving the flying carriage 29 and the fixed carriage 27 laterally of the axis of the mandrel 11A and the tube 21 being formed thereon, to cause the cutters 38 to move against the tube 21 and separate the stick into discrete container bodies. Structure for providing such movement of the cutter array 28 is well known in the art, and shown in the aforesaid Brigham patent.

The results obtained by the structure according to the present invention may be compared with the structure for which has been determined in the art the "planned trim"

method. Such is seen in FIG. 4, and the cutter array 28 has the cutters 38 thereof a fixed distance apart. The center one of such group of cutters is arranged to register with the indicia I marking the line of severance between container bodies four and five, the control of the cutter array 28 being achieved in part by a control lamp C.L. made a part of control circuitry well known in the art. The stick of containers 21 seen in FIG. 4 has an accumulative error like that as seen in FIGS. 1 and 2, each container body having an error therein for purposes of discussion hereat equal to 0.031 inch. The cutters being 9 inches apart, for example, the error accumulating in each half stick being 0.125 inch approximately. This results in the necessity of cutting a trim ring equal to 0.250 inch in length. Each of the container bodies to each side of the centermost cutter 38 has its pattern strip 18 slightly out of register as seen in FIG. 4, the amount of misregister increasing to each side of the centermost cutter 38.

Contrast the result achieved with the structure seen in FIG. 4 with that achieved by the structure according to the present invention. As seen in FIG. 5, each container body C is identical in appearance to all other container bodies, the error accumulating in the forming of the stick being proportioned and being distributed to the individual container bodies.

I claim:

1. In a machine for the production of helically wound tubular bodies from strip material, said machine including:
 - a. means for winding strip material on a mandrel to form a tube having recurring registration indicia thereon and for moving the tube axially along the mandrel;
 - b. cutting means positioned adjacent the tube for severing tubular bodies therefrom;
 - c. said cutting means comprising individual cutters mounted for axial movement relative to each other according to the distance between adjacent indicia of the tube;
 - d. the improvement in structure for effective movement of said cutters in the manner aforesaid which comprises:
 - e. a double rack having pinion means therebetween for providing movement to said cutters to space same by distances corresponding to the distance between the indicia on said tube;
 - f. means for supporting each of said cutters including a pinion of said pinion means;
 - g. motor means for rotating one of said pinions to follow the indicia between a pair of adjacent tubular bodies of said tube to cause said other pinions and the cutters cooperating therewith to adopt positions for cutting said tubular bodies to a length inclusive of the variation therein.
2. The invention according to claim 1 wherein said cutters are mounted as an array of same and are movable against said tube for cutting the same into discrete lengths.
3. The invention according to claim 1 wherein said motor means is controlled by photoelectric means.
4. The invention according to claim 3 wherein said photoelectric means is connected to circuit means controlling said motor means.
5. The invention according to claim 1 wherein one of said racks moves axially in accordance with the axial movement of said tube.

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