

[54] CONVEYOR SYSTEM FOR A CONTAINER

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[58] Field of Search. 198/130, 181, 137, 184, 204

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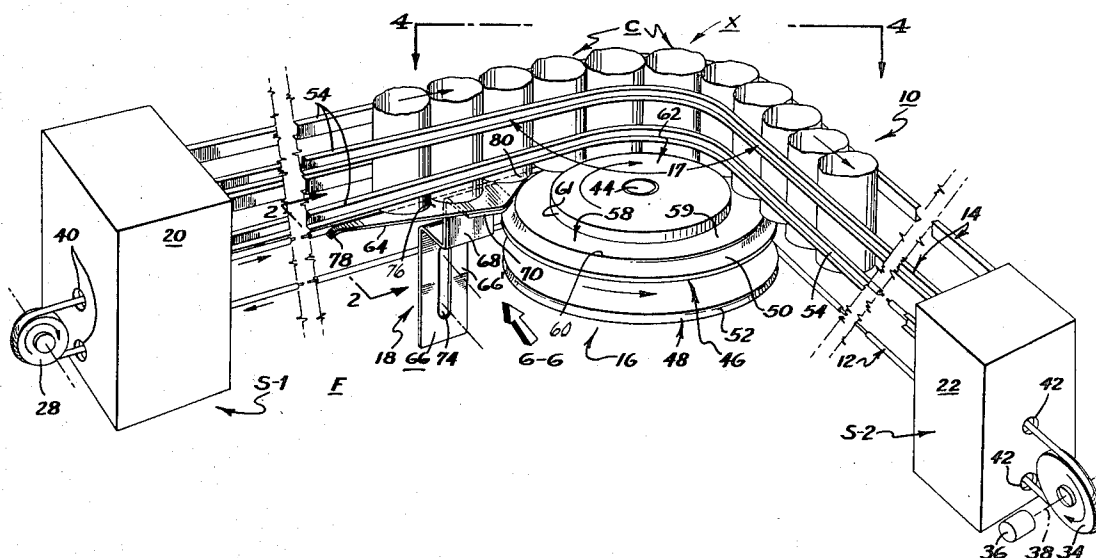
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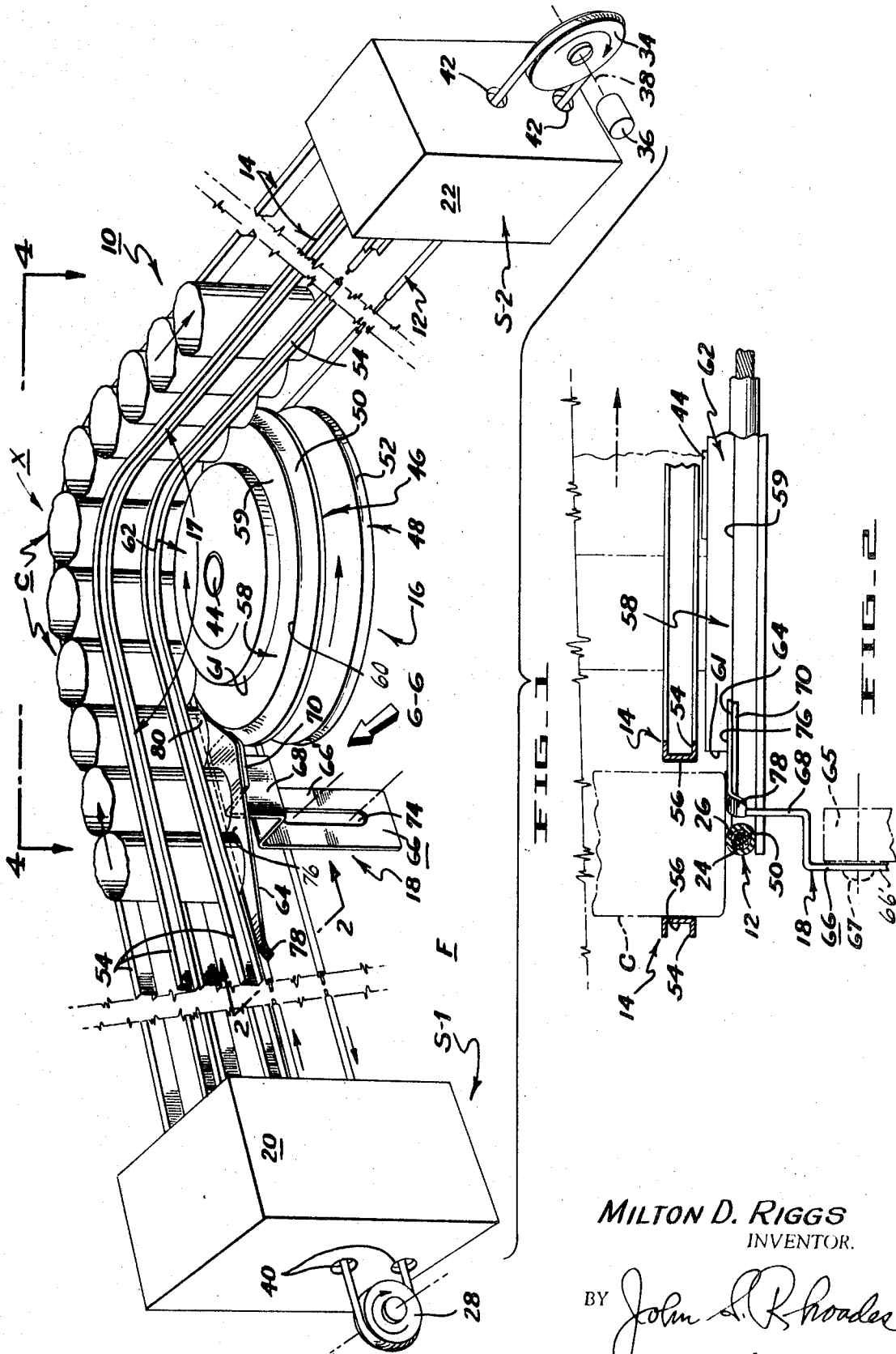
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[57] ABSTRACT

Improved conveyor system for transferring containers and in particular lightweight aluminum cans between stations in a container production plant and the like wherein novel means are provided for holding the container in firm engagement with a conveyor belt element at all times, including periods when the container's direction of travel is sharply or gradually changed during its passage between stations.

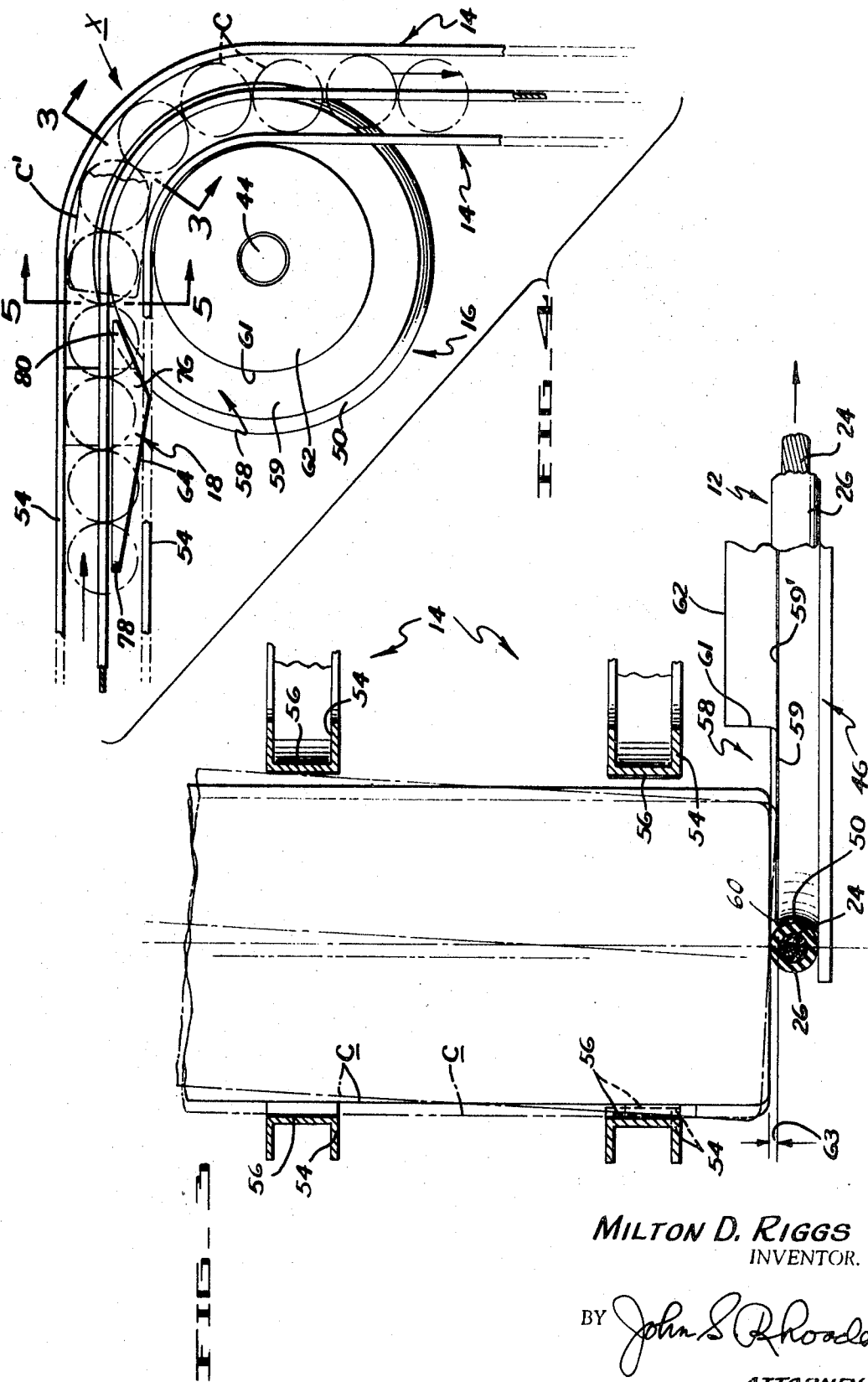
11 Claims, 6 Drawing Figures





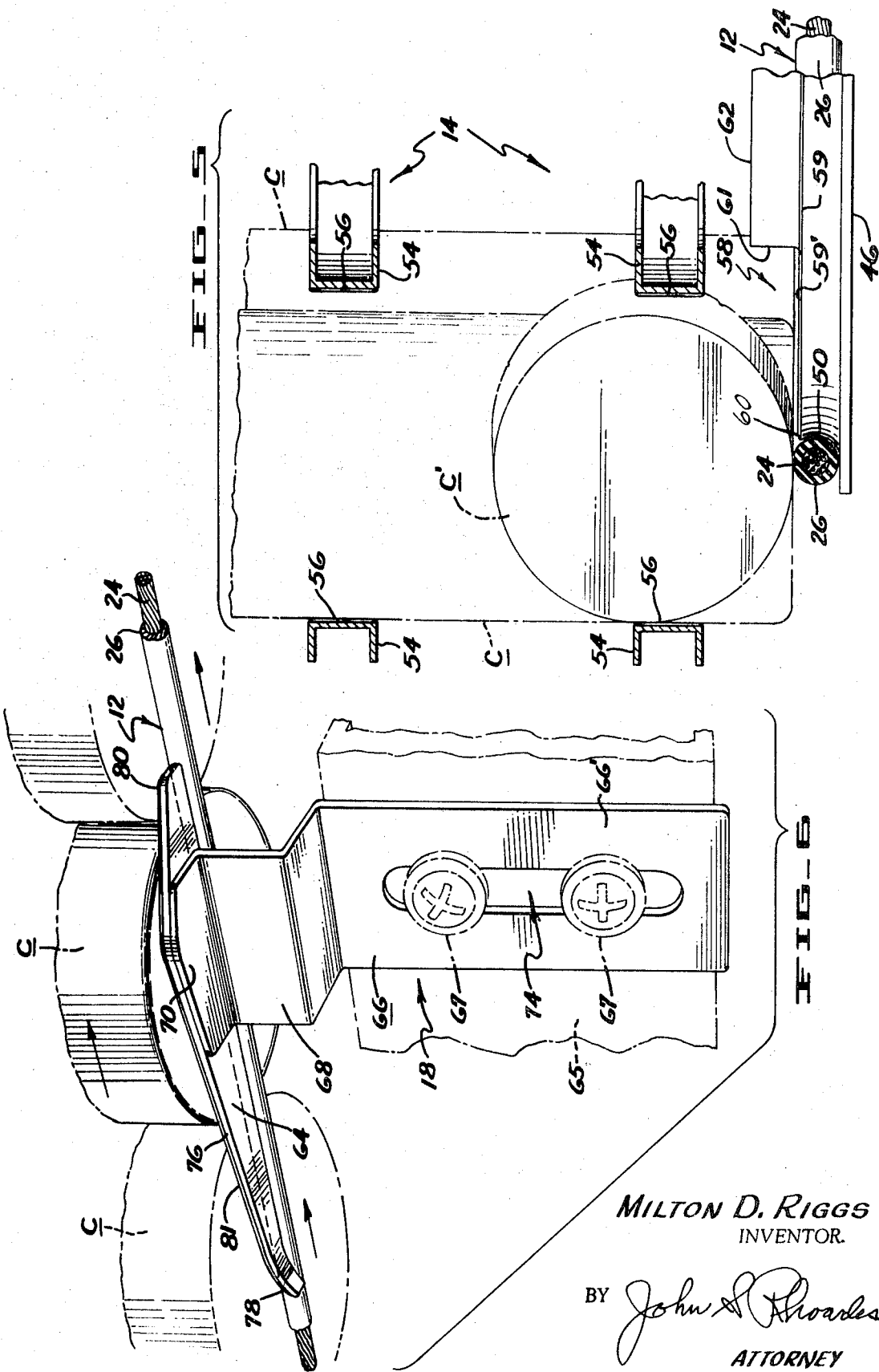
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CONVEYOR SYSTEM FOR A CONTAINER

BACKGROUND OF THE INVENTION

Typical in-plant apparatus designed in the past for transferring articles such as containers from one station to another are exemplified by U.S. Pat. Nos. 2,296,201 to Carter, issued Sept. 15, 1942, and 3,121,490 to Rainbow, issued Feb. 18, 1964. These prior art apparatus are not capable of properly handling lightweight aluminum containers, particularly when empty, because they fail to provide a means for satisfactorily holding the containers on the conveyor during rapid changes in the direction of travel of the conveyor. In-plant container conveyors must operate at substantial speeds to be practical and also make rapid changes in direction for various reasons, including space considerations in the facility where they are installed.

SUMMARY OF THE INSTANT INVENTION

It is the primary purpose of the instant invention to provide an improved in-plant conveyor system and the like for containers and in particular empty lightweight aluminum cans wherein a belt means is arranged and trained in an improved fashion about pulleys or sheaves such that a plurality of empty aluminum cans will be efficiently transported by the belt means at rapid rates between stations and around corners without bumping or banging into each other or flying off the belt means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an overall diagrammatic and perspective view with parts broken away and other parts removed of the preferred embodiment of a production line container conveyor system incorporating the novel features of the instant invention;

FIG. 2 is an enlarged cross-sectional view taken along line 2-2 of FIG. 1, with parts removed and with other parts being shown in dotted lines;

FIG. 3 is an enlarged cross-sectional view taken along line 3-3 of FIG. 4, with various positions of a can mounted on the conveyor system being indicated by dotted and solid lines;

FIG. 4 is an enlarged top plan view taken generally along line 4-4 of FIG. 1 and discloses a series of cans as they change their direction of travel along a selected route;

FIG. 5 is a cross-sectional view taken along line 5-5 of FIG. 4; and

FIG. 6 is an enlarged perspective view taken along line 6-6 of FIG. 1.

DETAILED DESCRIPTION

With further reference to the drawings, the container conveyor system 10 of the instant invention in a preferred embodiment advances a plurality of substantially contiguous light metal containers such as empty aluminum cans C at a relatively rapid rate and in single file between various container fabrication or filling stations S-1 and S-2 along, for example, a curvilinear conveyor line L. Conveyor system 10 advantageously comprises an endless driven cable-like belt element 12 extending between stations S-1 and S-2 of line L, spaced guard rails 14 disposed adjacent and on opposite sides of the upper reach of belt element 12, and an improved sheave 16 interposed between stations S-1 and S-2 for selective engagement of belt element 12 at a curve X in conveyor line L. It also includes a unique bridge and guide device 18 interposed between the upper reach of belt element 12 and the sheave element adjacent the area of initial tangential engagement of belt 12 with sheave 16 upon the advancement of the upper reach of the belt about the sheave in a clockwise direction. Stations S-1 and S-2 at the entrance and exit ends of line L can incorporate the appropriate equipment 20 and 22, not shown, for mass fabricating aluminum cans C.

For example, apparatus 20 diagrammatically illustrated at station S-1 in FIG. 1 can be draw and iron equipment of the type shown in U.S. Pat. No. 3,354,394 to Langewis, granted

Nov. 21, 1967, it being understood of course that suitable means would be used to transfer can C from apparatus 20 to belt 12. A conventional apparatus 22 schematically depicted at station S-2 in FIG. 1 can be a washer device for cleaning a drawn and ironed container and of the type shown in U.S. Pat. No. 3,262,460 issued July 26, 1966, which incidentally discusses in detail the difficulties involved in washing and handling empty lightweight aluminum cans. Apparatus 20 and 22 are normally floor-mounted, as generally indicated at F in FIG. 1. The usual framework for locating belt 12, spaced rail elements 14, sheave 16 and guide 18 in operative relation to apparatus 20 and 22 at stations S-1 and S-2 of production line L can be of the type as depicted in U. S. Pat. No. 3,313,400 to Johnson, granted Apr. 11, 1967.

The spaced rail elements between stations S-1 and S-2 of the production line advantageously hold the bottom of each can C in the line of cans in line L in a selected position on belt 12. Apparatus 20 at the entrance of the production line continuously feeds and deposits successive containers in a predetermined position and at a selected rate onto the upper reach of belt 12 while apparatus 22 at the exit of the production line continuously removes containers from the exit thereof at the same selected rate, thereby maintaining the number of cans C in the curved row of compact conveyor internested cans C between stations S-1 and S-2 substantially intact, as indicated in FIG. 1. As will become more apparent hereinafter, as each can C approaches guide 18 and sheave 16 at curve X of line L, the guide and the sheave advantageously cooperate with adjacent portions of both the upper reach of belt 12 and spaced rail elements 14 to maintain the can in a balanced and upright engagement with its particular associated part of belt 12 as belt 12, along with the can C, moves about the guide and sheave. One of the primary advantages of maintaining the container in engagement with belt 12 at all times between stations S-1 and S-2 is that it keeps the speed of movement of each can C at a fixed constant rate and effectively prevents injury to the can, such as denting, which can result in the rejection of a container.

When cans C are of drawn and ironed aluminum, they are generally of cylindrical shape with an open end and relatively thin bottom and side walls and weigh only a few ounces. Since these cans are mass produced for merchandising at a supermarket and the like, it is imperative that they retain a smooth and non-dented appearance. Otherwise the cans will not be acceptable for commercial distribution and marketing and will be rejected. Thus, in order for cans C to be produced in the most economical and acceptable manner, they have to be of light weight and thin walled construction, while being capable of being handled during fabrication at a relatively rapid rate and without their being dented or damaged.

It is to be understood, of course, that whenever the advancement of cans C in line L between stations S-1 and S-2 of the production line is stopped for any reason, such as for example during the malfunction of belt 12 or a malfunction of apparatus 22, the feeding and depositing mechanism of apparatus 20 is provided with appropriate means for stopping the feeding and depositing of containers C onto the upper reach of belt 12. Unless such precautionary steps are taken, excessive compacting of the cans C between stations S-1 and S-2 of the production line could take place and deleterious and permanent deformation of one or more containers or cans C result. Since neither the particular techniques or steps in which equipment 20 fabricates cans C and deposits the same onto belt 12 or the particular manner in which equipment 22 transfers the drawn container from the exit end of line L into equipment 22 where the cans C are cleaned, etc., constitute significant parts of the instant invention, no further discussion of the same is believed necessary.

Belt 12 is preferably constructed of a multistrand helically wound steel wire core 24 surrounded by an endless tubular sleeve 26 of a suitable grade of polyvinyl material, all as indicated particularly in FIGS. 2-3 and 5-6. Belt 12 is wrapped at one end thereof adjacent to equipment 20 about an idler

pulley 28 whereby the belt is advanced about pulley 28 in a clockwise direction, as shown, from the lower reach of the belt to the upper reach thereof upon its advancement. Pulley 28 is affixed to a support at station S-1 in a known manner whereby this pulley exerts sufficient tension on belt 12 during advancement thereof.

The other end of the belt that is located adjacent equipment 22 at station S-2 and at the exit of production line L is wrapped about a drive pulley 34 connected to a drive motor 36 by shaft 38. When motor 36 is electrically energized in a suitable manner, pulley 34 is driven as shown in the drawings in a clockwise direction whereby the belt is peripherally advanced about the driven pulley and its direction of travel fully controlled and reversed from the upper reach of the belt to the lower reach thereof as viewed in FIG. 1.

End portions of the upper and lower reaches of the belt are threaded through or across equipment 20 and 22 at stations S-1 and S-2 in a conventional fashion as indicated by two pairs of openings 40 and 42 respectively in FIG. 1.

Even though belt 12 can be satisfactorily tensioned by pulley 28, the lower and upper reaches of belt 12 intermediate the ends thereof can be supported by means of suitably mounted and longitudinally spaced idler pulleys that are in selective rolling engagement with the upper and lower reaches of the belt and which can be of the type illustrated in the aforementioned U.S. Pat. No. 3,313,400 to Johnson.

Sheave 16 is interposed between stations S-1 and S-2 of the production line L at curve X thereof and is specially constructed and arranged in selective engagement with the upper and lower reaches of belt 12 whereby the inlet and outlet portions of either the upper reach or the lower reach of the belt on opposite sides of the sheave define a selected angle therebetween of about 90°. This is substantially true for both the lower and upper reaches of the belt on either side of the sheave since these reaches are in substantial vertical alignment.

Sheave 16 is preferably comprised of a suitably mounted shaft 44, and upper stepped idler pulley 46 and a lower idler pulley 48. Both pulleys are journaled to the opposite ends of the shaft and are adapted to be simultaneously rotated in opposite directions about the shaft upon advancement of various portions of belt 12, all as indicated by the arrows in FIG. 1.

The outer peripheral stepped portion of upper pulley 46 is provided with an annular upwardly facing grooved surface 50 for receiving the upper reach of belt 12 when this upper reach of the belt is advanced about upper pulley 46. As indicated in FIGS. 1-5, a radial cross section of pulley 46 indicates that grooved surface 50 is of concave configuration with the radius of the concavity 50 approximating the overall radius of belt 12 whereby the upper reach of belt 12 can be freely received and positively held against annular grooved surface 50 during advancement and passage of the upper reach of the belt about pulley 46. Lower pulley 48 is likewise provided with an annular groove 52. The radial cross section of the concavity 52 approximates that of belt 12. The lower reach of belt 12 passes through the groove 52 upon advancement of the lower reach thereof about pulley 48 in a manner illustrated in FIG. 1.

As the line of contiguous containers C moves rapidly with belt 12 between stations S-1 and S-2 of production line L, they are held in an upright position by means of spaced guard rail elements 14 provided on opposed sides of the upper reach of belt 12. Spaced guard rail elements 14 preferably comprise two pairs of spaced channel-shaped elements 54, each pair being made of vertically aligned elements disposed on opposite sides of the upper reach of the belt. Upper channel elements 54 of both pairs of elements are preferably disposed in horizontal alignment relative to each other as well as in vertical alignment with the lower channel elements.

The various guard rails 54 are arranged relative to belt 12 whereby they will force the moving cans C to engage and rest upon the upper reach of belt 12 at substantially the transverse center line or diameter of the can as the cans or containers are advanced along the line L between stations S-1 and S-2. Ac-

cordingly, the two channel-shaped elements 54 disposed on opposite sides of the upper reach of belt 12 are spaced apart by a distance that is slightly greater than the overall diameter of a can C in order that the container can freely travel along with portions of the upper reach of the belt upon which it rests between the two pairs of elements 54.

The exposed or can contacting side of the webs of elements 54 are provided with a relatively friction-free coating 56 of uniform thickness throughout their lengths whereby there will be no binding between cans C and elements 54 as the cans C flow past elements 54. Coating 56 can be a suitable plastic material such as nylon.

As containers C travel in a continuous and progressive unending flow and in compact conveyor interrelated relation from station S-1 and to S-2 certain of the moving containers C may tend to tilt about the belt 12 whereby the top sidewall of one container will slidably contact one of the top guard rails 54 while the bottom side wall of the same container will slidably contact the opposing lower guard 54, all as indicated in FIG. 3.

The lower elements 54 of both pairs of elements are preferably spaced slightly above the top of pulley 46 in the manner best shown in FIGS. 1 and 5. The upper channel-shaped elements 54 of both pairs of elements are preferably spaced at a distance above the lower elements 54 of both pairs of elements so that the top flange surface of the upper elements 54 of both pairs of elements 54 are disposed adjacent to the open upper end of a container C resting on the upper reach of belt 12 in the predetermined position as aforescribed.

With particular reference to FIGS. 1-5, stepped pulley 46 is provided with an inner annular stepped or cutaway portion 58 disposed radially inward of and adjacent to outer annular groove 50. The flat end face 59 of stepped portion 58 extends from peripheral edge 60 adjacent groove 50 to the upwardly protruding hub 61 of inner section 62 of sheave 46 as indicated in FIGS. 3 and 5.

As best shown in FIGS. 2 and 3, face 59 of pulley 46 is in effect disposed above outer annular stepped groove surface 50. At the same time end face 59 is spaced below the extreme top surface of the belt 12 in direct contact with the cans C in order to define a gap having a selected vertical extent in the manner indicated at 63 in FIG. 3 as the cans are advanced about the sheave.

This desirable spacing of the inner end face 59 of pulley 46 below the topmost outer surface point of belt sleeve 26 will ordinarily mean that a portion of the bottom of a container C will remain engaged with belt 12 during advancement of the container about sheave 46. At the same time the bottom of the container readily glides or floats across sheave 16 rather than bindingly engaging this sheave even though the bottom thereof may tilt toward end face 59 of pulley 46 and into contact with certain guard rails 54, all as indicated by dotted lines in FIG. 3. As a result of such tilting of the container in the fashion shown in FIG. 3, the two pairs of elements 54 normally cooperate to arrest tilting actions of the container C so that the bottom of the container will preferably not come into contact with inner end face 59.

As further indicated in FIG. 3, even if perchance a given container C should tilt to such an extent as to contact sheave surface 59 of pulley 46 as the belt 12 advances along groove 50 of pulley 46, the tilted container C would still maintain primary contact with the topmost part of the upper reach of belt 12 and be quickly passed across the sheave 16 before the container can seriously bindingly engage the sheave and hesitate or halt in its forward advance across the sheave. If this occurs and there is a separation of adjoining containers, an impacting of containers between stations S-1 and S-2 will occur upon reestablishment of the compact flow of containers between stations S-1 and S-2. Impacting of the containers due to an interruption in the flow of one or more cans usually results in some form of injury to the sidewalls of one or more impacted containers, such as denting. If desired, and in order to

minimize tilting of a container as it advances about pulley 46 of the sheave, an element 54 of the two pairs of elements 54 can be offset in a radial direction toward the upper reach of belt 12 such as for instance the outer lower element of the outer pair of elements 54 of both pairs thereof as indicated by dotted lines in FIG. 3.

Inner end face 59 of pulley 46 can be coated in a suitable fashion with a relatively friction-free coating, for example, a nylon coating in the manner indicated at 59' in FIGS. 3 and 5 so as to minimize burnishing or other deformation on the finish of the bottom of the container in the event it tilts into engagement with the end face 59 of pulley 46 despite the counteraction of the two pairs of rail elements 54.

In order to minimize excessive tilting of a container C prior to advancement of the container together with advancing belt 12 about the upper pulley of sheave 16, a unique guide 18 can be interposed between upper pulley 46 of the sheave and the belt just prior to the belt making its initial tangential engagement with the outer groove 50 of the pulley. In one advantageous embodiment of the instant invention guide 18 can be made up of a sheet metal guide 64 and a support bracket 66 suitably welded thereto. Guide element 64 is of generally flat configuration and of approximately triangular shape. Support bracket 66 is an elongated strip having an approximately Z-shaped and stepped flange 68 at one end thereof. The outermost flange portion 70 of stepped flange 68 has a V-shaped end 72, the apex of which substantially corresponds to and mates with the intermediate apex portion of guide 64. Outermost flange portion 70 of support 66 is overlapped with and connected to guide element 64 in the manner illustrated in FIGS. 1-2, 4 and 6.

The bottom leg 66' of support 66 has a longitudinally extending closed end slot 74. The cap screw assemblies 67 mounted in this slot and anchored to a support 65 in the manner illustrated by dotted lines in FIG. 6 can be used to adjust guide 64 relative to belt 12. When guide 64 is properly adjusted on support 65, the upwardly facing surface 76 of guide 64 is preferably disposed in tangential alignment relative to the top surface of the sleeve of the upper reach of the belt as indicated in FIG. 2.

As indicated in FIG. 2, stepped flange 68 is so formed as to allow for adequate clearance between it and the adjacent portions of the upper reach of belt 12 whereby belt 12 during its advancement will not ordinarily come into contact with flange 68.

Due to the fact that top surface 76 of guide 18 as viewed in FIG. 2 is disposed in horizontal planar tangential alignment with the top of the upper reach of belt 12, it normally will only gently and slidably contact the bottom of container C as it advances along with the belt toward sheave 16. This contact between a can C and guide 18 results in the can C remaining in an upstanding predetermined position without tilting just prior to its advancement about the sheave, thereby minimizing tilting of the container and maintaining it properly elevated relative to sheave 16 as it advances about the sheave. The sharply angled exit or trailing longitudinal end 80 of guide plate 64 is adapted to be inserted in knife-like fashion within the opening that exists between the outer peripheral edge of pulley 46 and the upper reach of belt 12 just prior to initial tangential engagement of the upper reach thereof with pulley 46. Location of end 80 of element 64 in this fashion guarantees the smooth transfer of a can C from guide 18 to sheave 16 in the desired elevational relationship thereto as each can C remains in primary contact with the top of the upper reach of the belt 12 as it turns a corner and relies primarily on the belt for such change in direction as well as movement. The end 80 of plate 64 should be cut on an angle, preferably 25°, at the curve X of production line L in order to obtain the best results.

In one advantageous embodiment of the invention the forward end 78 of element 66 is bent downwardly such that it has a curvature of generous radius, all as indicated in FIGS. 1-2, and 4 and 6. Forward end 78 of guide 16 thus acts as a ramp for directing each container C in the line L upwardly, if neces-

sary, and into assured proper sliding contact with surface 76 of the guide 18 such as when an approaching can C is tilted about the belt in the manner indicated in FIG. 3. If forward end 78 of the guide were not bent downwardly, as aforescribed, it could possibly present an obstruction to a forwardly moving container that might result in an upending of a container whereby the sidewall portion of the container would rest on the belt 12 and cause jamming of the line L and other equipment. If desired, upper surface 76 of plate 64 can be provided with a nylon coating in the manner illustrated at 81 in FIG. 6.

Lower guide elements 54 of both pairs thereof are preferably so located relative to belt 12 whereby, if, as noted in FIGS. 4 and 5, a container C' is accidentally tipped over and rests on belt 12 by way of its sidewall rather than its bottom, the container will still be moved along the line L.

In the event the tipped-over container becomes locked or lodged between the lower rail elements 54 as it advances about the sheave, thereby stopping the normal advancement of the containers C following the lodged container, it is to be understood that means well known in the art would be provided for stopping the feeding of further containers from station S-1 until the tipped-over and locked container C is removed from the conveyor system by an operator.

The instant conveyor system can be operated at a speed such that empty aluminum cans weighing but a few ounces can be transported at rates as high as 600 cans per minute between stations S-1 and S-2 of the conveyor system. In order to get the best results, end face 59 of pulley 46 is preferably disposed about one thirty-second inch below the top surface of sleeve 26 of the upper reach of belt 12 at the point of contact between belt and pulley 46.

Although the conveyor system of the instant invention has been illustrated as particularly useful in handling containers C that move in a contiguous and endless flow pattern between stations S-1 and S-2, it can handle equally well single containers C or an intermittent flow of containers C between stations S-1 and S-2. Depending upon the height and shape of an article handled by the conveyor system, guides 14 need comprise only a single instead of a double pair of guides 54. Articles conveyed by the conveyor system in intermittent or continuous fashion could be of spherical, polygonal or irregular shape and of solid, instead of hollow, construction.

Although the production line has been illustrated as containing a single sheave 16 and guide 18 at a singular curve between stations S-1 and S-2, line L could be provided with multiple sheaves 16 and guides 18 depending upon the various paths to be taken by the line L. The curve or directional change in line L at which the sheave 16 and guide 18 are located could be gradual, sharp or even a hairpin curve. If the flights of belt 12 between stations S-1 and S-2 are disposed at a downward or upward inclination other than the level inclination shown in FIG. 1, sheave 16 can be pitched at a suitable angle to assure proper engagement of upper and lower reaches of the belt as the reaches advance about pulleys 46 and 48. Even though guide plate 64 preferably has a flat surface 76, it could be of arcuate shape in a direction transverse of the belt, such arcuate shape of course usually depending upon the shape of the article being handled by the conveyor system.

Advantageous embodiments of the instant invention have been shown and described. It is obvious that various changes and modifications may be made therein without departing from the appended claims, wherein:

What is claimed is:

1. In a conveyor system for transporting successive lightweight and contiguously arranged containers from one station to another and along a selected path of travel that includes a container supporting belt means having an arcuate segment for receiving and transporting the containers, means for driving said belt means, guard rail means disposed along said path of travel adjacent to and on opposite sides of said belt means and above the level of the bottoms of the containers for slidably contacting the walls of the containers and restraining said containers against excessive tilting during the

advancement of said belt means along with the containers, a sheave means disposed adjacent to the arcuate segment of the path of travel of the belt means and engageable with said belt means, said sheave means including a portion that terminates at the outer periphery thereof in an offset upwardly facing concave groove portion having a radius approximating that of the belt means for receiving the belt means at said arcuate segment of the said path of travel, said arcuate segment also constituting a point of directional change of the belt means, and the cross-sectional dimension of the belt means being greater than the height of the groove portion of the sheave means whereby the belt means will overfill the top of said groove portion and project upwardly above the said groove portion and whereby a container in engagement with said belt means at said point of directional change will be elevated relative to the underlying portion of the sheave means so that the belt means can remain the primary mover of a container through said point of directional change.

2. A conveyor system as set forth in claim 1 including a bridge and guide means interposed between said sheave means and said belt means adjacent the point of tangential engagement of said belt means with the groove portion of said sheave means.

3. A conveyor system as set forth in claim 2 in which a section of said bridge and guide means is disposed in general alignment with the top surface of said belt means.

4. A conveyor system as set forth in claim 3 including means for adjusting said bridge and guide means.

5. A conveyor system as set forth in claim 1 in which said rail means is covered with a relatively friction-free coating.

6. A conveyor system as set forth in claim 2 in which said bridge and guide means includes a relatively friction-free coating.

7. A conveyor system as set forth in claim 1 in which the stepped portion of said sheave means is provided with a relatively friction-free coating.

8. A conveyor system as set forth in claim 1 in which said belt means is comprised of a core made up of a multistrand, helically wound cable and a tubular sleeve of plastic material surrounding said core.

9. A conveyor system as set forth in claim 2 in which said bridge and guide means is comprised of an approximately triangular-shaped guide plate.

10. A conveyor system as set forth in claim 1 wherein said belt means comprises a circular cable-like member in cross-section so arranged between said guard rail means as to engage the bottom of a container in a bisecting fashion.

11. A conveyor system as set forth in claim 2 wherein the top surface of the bridge and guide means is offset upwardly from the stepped portion of the sheave means.

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