Nov. 10, 1964 R. K. GALLOWAY 3,156,167

CARTON HANDLING APPARATUS

Filed May 7, 1962

6 Sheets-Sheet 1

FIG_1

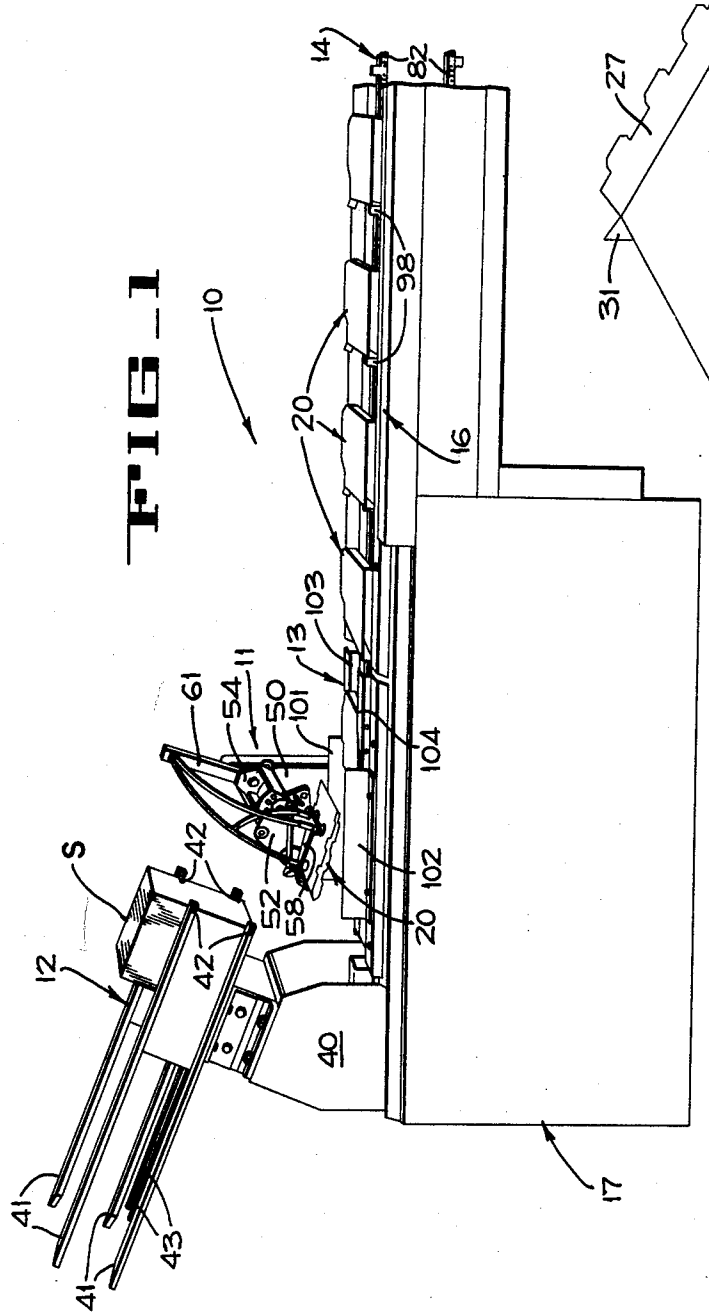
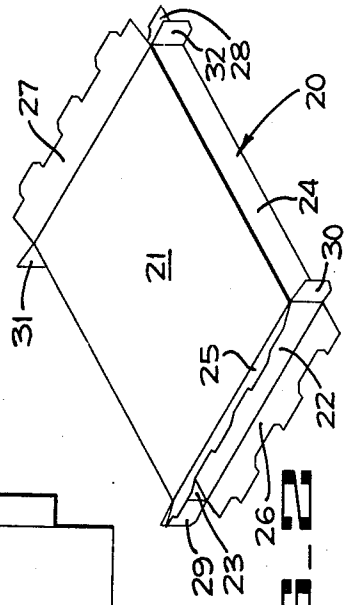


FIG_2



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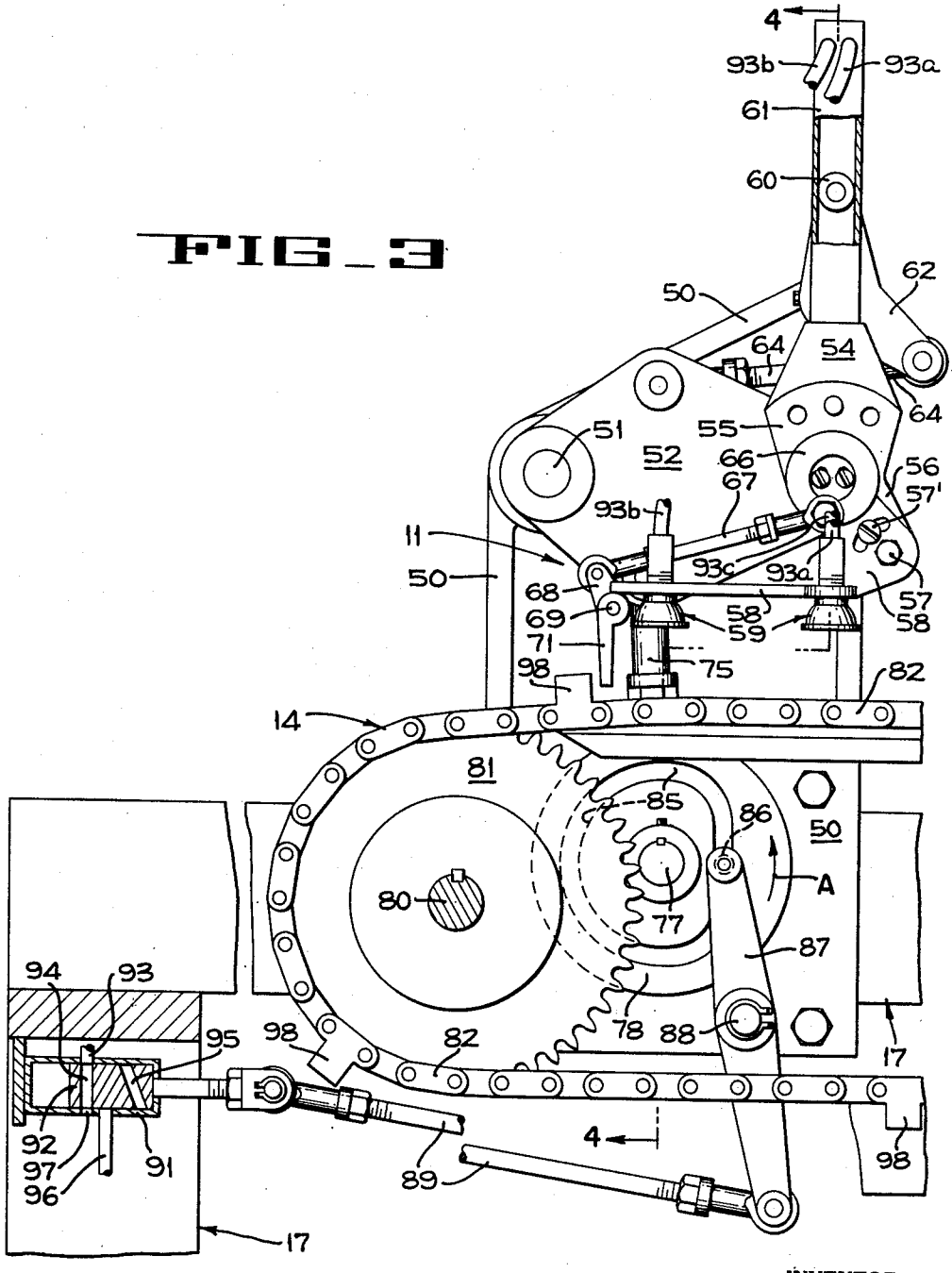
Nov. 10, 1964 R. K. GALLOWAY 3,156,167

CARTON HANDLING APPARATUS

Filed May 7, 1962

6 Sheets-Sheet 2

FIG_3



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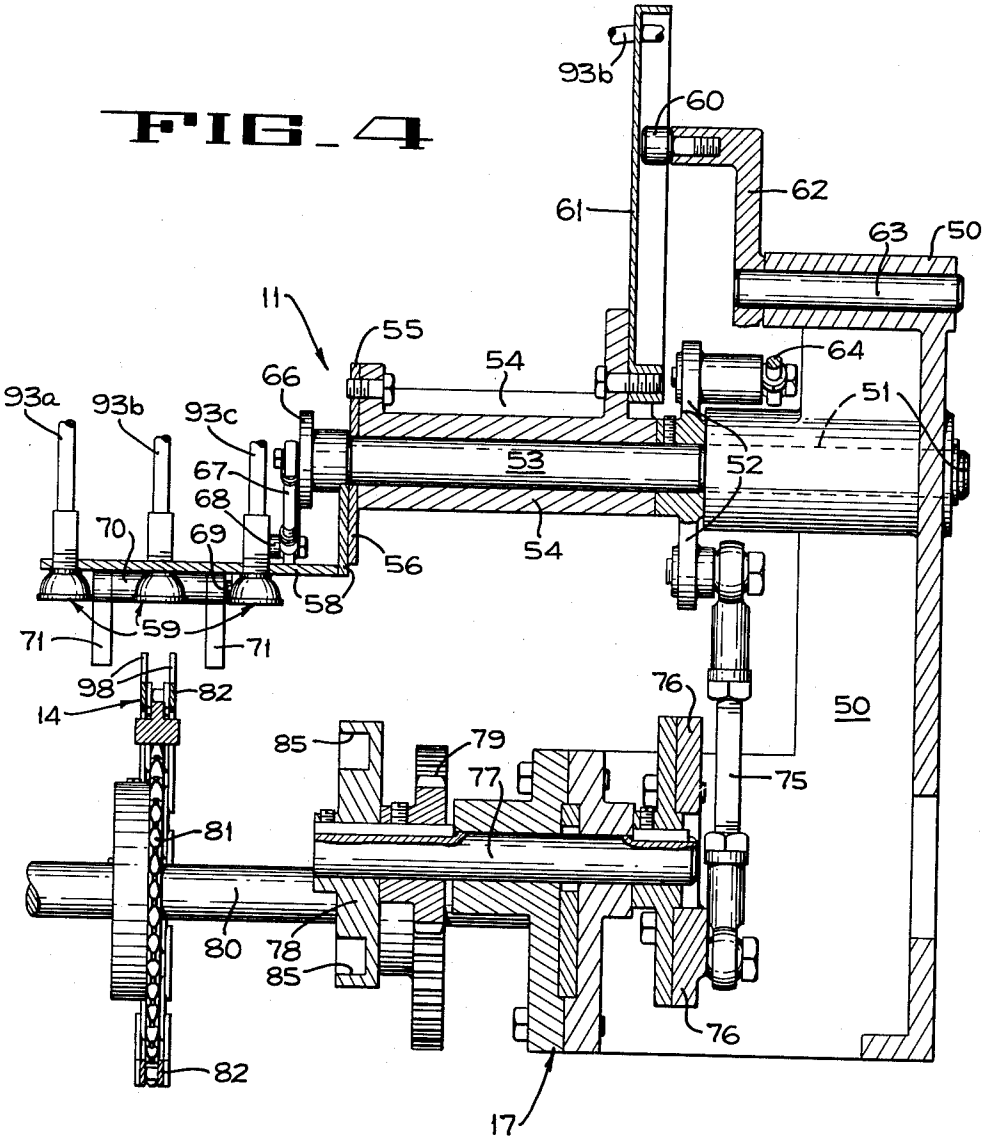
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Nov. 10, 1964 R. K. GALLOWAY 3,156,167

CARTON HANDLING APPARATUS

Filed May 7, 1962 6 Sheets-Sheet 3

FIG_4



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CARTON HANDLING APPARATUS

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FIG_5A

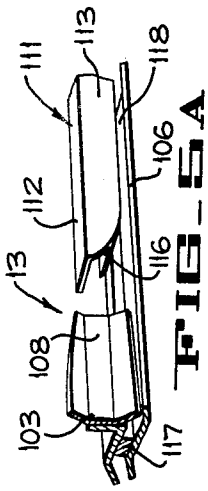


FIG_5

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Nov. 10, 1964 R. K. GALLOWAY 3,156,167

CARTON HANDLING APPARATUS

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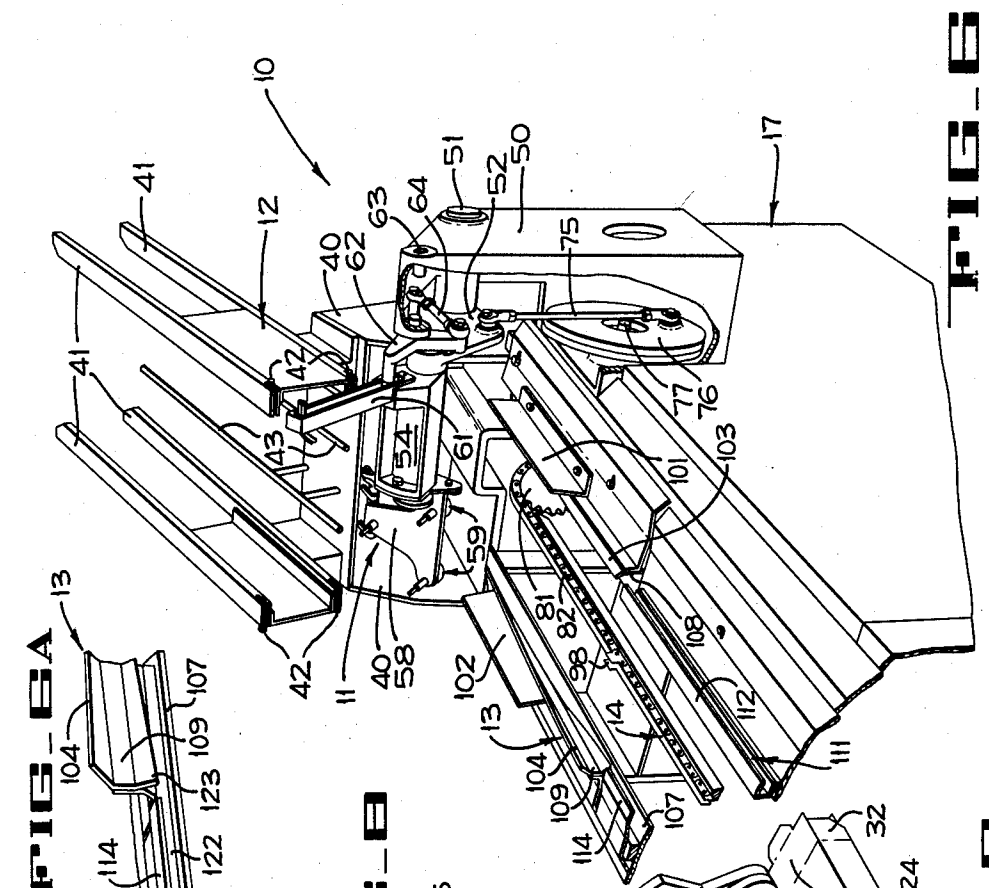


FIG. 6

FIG. 6A

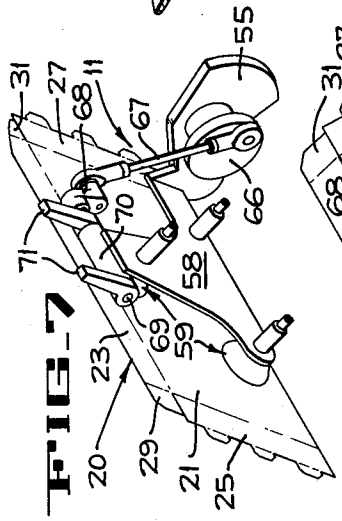


FIG. 7

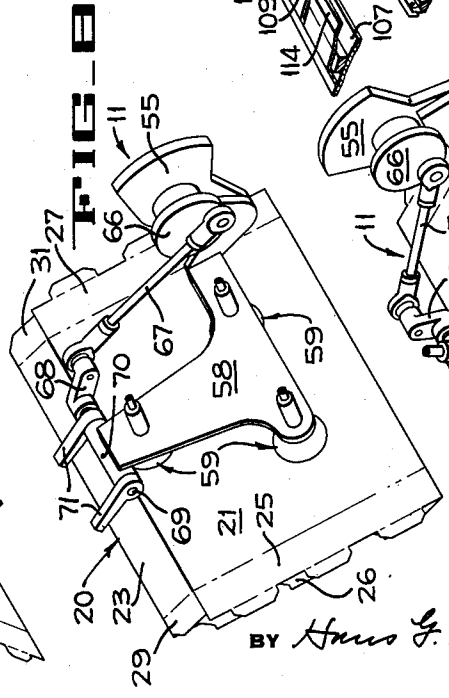


FIG. 8

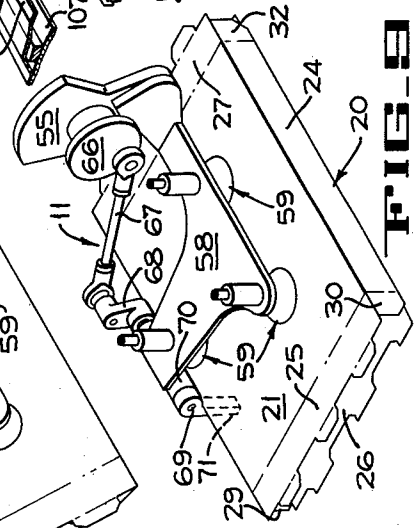


FIG. 9

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FIG_10

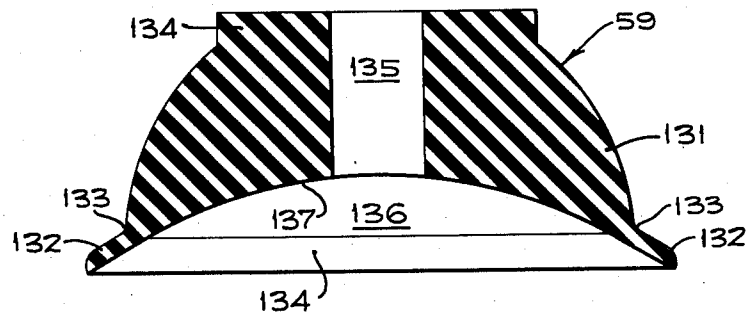
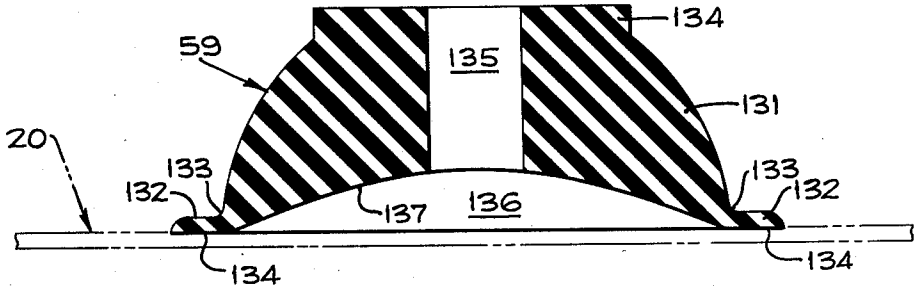


FIG_11



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United States Patent Office 3,156,167 Patented Nov. 10, 1964

3,156,167

CARTON HANDLING APPARATUS

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Filed May 7, 1962, Ser. No. 192,833
6 Claims. (Cl. 93—53)

The present invention pertains to carton handling apparatus and more particularly to apparatus for feeding collapsed carton blanks from a magazine to a conveyor, erecting the carton blanks during such feeding operation, and keeping the erected cartons in their rectangular tubular shape during their movement upon the conveyor so that they may receive their intended contents.

Cartoning machines are quite widely used in the packaging industry in the production of a great variety of cartoned materials. These machines are adapted to operate on carton blanks, which may be in any one of several intermediate processing stages, by performing the concluding operations on the cartons including the filling operation, so as to continuously produce filled and sealed carton-type packages at a high rate of speed to meet the requirements of modern economical production. In accordance with the present invention, the subject cartoning apparatus is adapted to handle pre-cut carton blanks with the end tabs and flaps pre-formed and with score lines provided to define the folded edges of the finished carton. In addition, the carton blanks have been folded into tubular form with one of the side panels glued to a top panel after which they have been flattened to dispose one side panel and the top panel in coplanar alignment and lying flat against the coplanar bottom panel and other side panel, so as to present collapsed tubular blanks. The blanks are stacked in this collapsed state for feeding to the apparatus of the present invention which apparatus receives the blanks one at a time, erects each of them into the form of an open ended tube, and feeds them to a filling station.

In general, machines of this nature have been quite costly to produce and contain numerous complex mechanisms and operative parts.

It is an object of the present invention to provide an improved carton handling machine.

Another object of the invention is to provide an improved carton handling apparatus which will provide for the rapid feeding, erecting and conveying of cartons, which is of simplified construction consisting of a relatively small number of parts, which is inexpensive to manufacture and which is relatively simple in operation.

Another object is to provide a carton blank feeding mechanism which will erect carton blanks into rectangular tubular shape as they are transferred from a stack to a conveyor for filling.

Another object is to provide apparatus for transferring carton blanks from a stack to a filling station wherein the blanks are erected during the transference and retained in erect condition as they are brought into position to be filled.

Another object is to provide improved apparatus for receiving an erected carton blank, propelling it toward a filling station, and squaring it up into a position to be filled.

Another object is to provide an improved method for simultaneously conveying collapsed carton blanks from a stack to a filling area and erecting the blanks into tubular form.

Another object is to provide a suction cup usable with the apparatus of the present invention which will provide a high pulling power per cup area to maintain a maximum vacuum force against the carton blank held thereby.

These and other objects and advantages of the present

invention will become apparent from the following description and the accompanying drawings, in which:

FIG. 1 is a perspective showing the apparatus of the present invention in operating condition, feeding and erecting a plurality of carton blanks.

FIG. 2 is a perspective of a carton of a type which the apparatus of FIG. 1 is adapted to handle.

FIG. 3 is a fragmentary, partly broken away, side elevation of the feeder mechanism and its associated structure, drawn to an enlarged scale.

FIG. 4 is a section taken on the lines 4—4 of FIG. 3.

FIG. 5 is a front fragmentary perspective of the apparatus of the present invention showing the feeder mechanism in one stage of its operation with the cartons being shown in phantom lines.

FIG. 5A is a diagrammatic fragmentary perspective showing a portion of the end tab and flap manipulating structure of FIG. 5.

FIG. 6 is a rear perspective of the apparatus of FIG. 5 with parts broken away.

FIG. 6A is a diagrammatic fragmentary perspective showing a portion of the end tab and flap manipulating structure of FIG. 6.

FIGS. 7, 8 and 9 are diagrammatic fragmentary isometrics illustrating the operation of the suction cup transfer arm.

FIG. 10 is an enlarged central section through one of the suction cups of the apparatus of the present invention.

FIG. 11 is a view similar to FIG. 10 showing the cup in the form which it assumes when performing its gripping function.

Referring now more particularly to the drawings, FIG. 1 shows a portion of a complete cartoning machine **10** including an embodiment of the carton handling apparatus of the present invention. The purpose of this apparatus is to continuously erect flattened tubular carton blanks into rectangular tubular form and convey them to a position wherein they may be filled. In accordance with this purpose, an oscillating suction-cup feeder mechanism **11** is arranged to transfer carton blanks one at a time from a stack S of the blanks in a magazine **12** to a conveyor and end flap manipulating apparatus **13** which includes an endless chain-and-sprocket conveyor **14** for propelling the carton blanks. The blanks are first erected from their flattened shape to rectangular, tubular form on the feeder mechanism, and then they are placed upon the conveyor **14**, where they are retained in that form until they are filled either manually or by means of automatic carton filling apparatus at a filling station **16**. The conveyor then transports the filled cartons to a closing station (not shown) where they are closed, the details of such closing station forming no part of the present invention. The above named mechanisms are all mounted upon a support structure **17** to form the integrated carton processing machine **10** only a portion of which is seen in FIG. 1.

FIG. 2 illustrates a carton of a general type which the apparatus is designed to handle. The carton, generally designated as **20**, is of the rectangular tubular type having pre-cut end flaps which are adapted to be folded inwardly to present a closed carton. As seen in FIG. 2, the carton is in the position in which it rides over the conveyor and flap manipulating apparatus **13** except that the end flaps and tabs have been bent outwardly so as to better illustrate the complete carton structure. This carton structure includes a top panel **21**, a bottom panel **22**, side panels **23** and **24**, end flaps **25**, **26**, **27** and **28**, and end tabs **29**, **30**, **31** and **32**. As is usual with such cartons, the blanks are made with score lines separating the panels from each other and from the end flaps and tabs. When the blanks are stacked within the magazine **12** they are of tubular form but in completely flattened condition. The carton erecting operation performed by the feeding

mechanism 11, presently to be described in detail, brings each of the side panels 23 and 24 from a planar relationship into a perpendicular relationship with the top panel 21 and with the bottom panel 22, respectively, by bending the blank at the pre-formed score lines separating these panels. It should be noted that the upper end flaps 25 and 27 are wider than the corresponding lower flaps 26 and 28, respectively. The primary reason for the extra width is to aid in closing the carton; however, such structure is also of importance in the operation of the apparatus of the present invention, as will presently be described.

The carton blanks 20 in their flattened condition are initially placed in a stack S (FIG. 1) in the magazine 12, each blank occupying a nearly vertical plane. The magazine is located at one end of the cartoning machine 10, being elevated from the main support structure 17 by a pedestal 40. Forming a rack for the carton blank stack are aligned pairs of spaced guide rails 41, each of which is equipped with a stop pin 42 at its forward end to releasably retain the stack of blanks within the magazine. The blanks are supported on edge upon skids 43 which slidably support the entire stack between the guide rails, so that gravity holds the stack together with the lowermost carton blank in engagement with the stop pins 42 in position to be received by the feed mechanism 11.

The oscillating suction cup feeder mechanism 11 and its associated structure, shown in detail in FIGS. 3 and 4, serve to transfer one carton blank during each oscillation of the feeder mechanism from the magazine 12 to the conveyor and tab manipulating structure 13. In order to accomplish this, a heavy support structure 50 is located at the rear of the frame 17 next to the magazine to support the bulk of the structure of the feeder. Rotatably mounted in the support structure 50 is a shaft 51 which is fixed to one corner of a diamond-shaped carrier plate 52 (see FIG. 3). The carrier plate is thus mounted for rotation with the shaft 51. Fixedly attached to the carrier plate for rotation about the projected axis of the shaft 51 is a second shaft 53 which extends from the opposite corner of the carrier plate 52. Thus, the two shafts 51 and 53 extend in opposite directions from the carrier plate 52. The shaft 53 carries a housing 54 which is free to rotate about it. The housing 54 has a pivot plate 55 rigidly attached thereto at its outer end, as best shown in FIG. 4. The plate 55 includes an ear 56. Adjustably mounted upon the ear by means of two bolts 57, 57′ is a suction-cup bracket 58 which carries three suction cups 59 for gripping and transferring the carton blanks, each carton blank being gripped by all three cups on its forwardly facing top panel 21.

Pivotal motion of the carrier plate 52 about the axis of the shaft 51 imparts an arcuate motion to the shaft 53 and the suction-cup bracket 58 carried thereby, which brings the bracket from a position overlying the conveyor 14 (FIGS. 3 and 4) to a position confronting the magazine 12. Since the housing 54 which supports the suction-cup bracket is free to rotate about the shaft 53, however, a second motion can be transmitted to the bracket. This is accomplished by means of a bell crank connection to the housing 54 including a radially extending channel 61 fixed to and extending upward from the housing and a bell crank 62 which is rotatably mounted upon the support structure 50 by means of a pin 63. Rotatably secured to one lever arm of the bell crank 62 is a cam roller 60 which operates within the channel. The other lever arm (shown in FIG. 3) of the bell crank pivotally receives one end of a tie rod 64 which is pivotally connected at its other end to a third corner of the diamond shaped carrier plate 52.

It is apparent, therefore, that when the carrier plate 62 is pivoted, the tie rod 64 is moved to cause the bell crank 62 to pivot and rotate the channel 61 and, hence, the housing 54 and suction-cup bracket 58. The bracket is thus subjected to a compound movement due to the

arcuate movement of shaft 53 about shaft 51 and due to the independent rotation of the housing 54 about the shaft 53. This compound movement is such that the bracket is subject to both a clockwise and a counterclockwise rotational movement. It is pulled almost directly away from the magazine during the initial phase of its movement due to the pivotal movement of the carrier plate as it is itself reversely pivoted about the axis of shaft 53 toward the conveyor so that the carton blank which is engaged by the suction cups will clear the stack as it is swung into a horizontal position above the conveyor 14.

One of the features of the present invention is that the carton blanks are erected as they are moved into position on the conveyor. The structure responsible for this function includes a hub 66 which is rigidly attached to the end of the shaft 53 and a rod 67 which is eccentrically and pivotally mounted at one end upon the hub and which is pivotally connected to a crank 68 at its opposite end. The crank is fixed to a pin 69 which is rotatably mounted in a tubular housing 70 at one end of the suction-cup bracket 58 and carries a pair of erector fingers 71 which are adapted to rotate with it while engaging one of the side panels 23 or 24 of a carton supported by the suction cups 59 and thus to erect the carton blank into a rectangular shape. Since the pivotal movement of the bracket is relative to the movement of the shaft 53 and its attached hub 66, the erector fingers will be pivoted approximately 90° during the movement of the bracket from its uppermost position to its lowermost position, as shown in FIGS. 7–9. This motion of the erector fingers 71 relative to the edge of the suction-cup bracket serves to erect the carton, placing it in such a form that it can be filled, as will be more fully described hereinafter in the summary of the operation of the subject apparatus.

The feeder mechanism is operated by rotating the carrier plate 52 about the shaft 51 as was previously pointed out. In order to accomplish this, a connecting rod 75 is pivotally connected to the fourth corner of the carrier plate and to a crank plate 76 which is keyed into one end of a driven shaft 77. Attached to the other end of the shaft is a vacuum valve actuating cam 78. The shaft is driven by means of a spur gear drive 79 from a shaft 80 which is journalled in the support structure 17 and is rotated by the chain-and-sprocket conveyor 14 through the driven sprocket member 81 thereof. The chain 82 of the conveyor 14 is driven by a motor (not shown) which may be at the closing station end of the cartoning machine 10.

The intermittent application of vacuum pressure to the suction cups 59 is effected through a vacuum pump system, seen in FIG. 3. The vacuum valve actuating cam 78 which is continuously rotated by the shaft 77 has a semicircular-oblate groove 85 formed on its outer face. The groove receives a cam roller 86 which is rotatably mounted on one end of a lever 87. Intermediate its ends, the lever is pivotally mounted upon the frame 50 by a pivot pin 88. The other end of the lever is rotatably linked with a connecting rod 89 which controls a vacuum valve 91 through a piston 92 so as to alternately supply air and vacuum to a hose line 93 which communicates with hose lines 93*a*, 93*b* and 93*c*, each of which leads to one of the suction cups 59. The vacuum valve is of standard construction and includes two passages 94, 95 within the piston 92 which are adapted to alternately provide the hose line 93 with vacuum from line 96 and atmospheric pressure through an air vent 97. The line 96 is supplied with a vacuum by a vacuum pump (not shown) which may be mounted on the frame 17.

As the shaft 77 is rotated, the cam 78 causes the lever 87 to pivot between two positions which, in turn, opens and closes the vacuum valve 91 to intermittently apply a suction force to the suction cups 59. When the cam roller 86 is centered in the oblate portion of the groove 85, as is depicted in FIG. 3, the vacuum valve will be

in a closed position with the piston 92 withdrawn so that the passage 94 will link the suction cup supply hose 93 with the atmospheric pressure vent 97. This position corresponds with the lowermost position of the bracket 58 wherein the cups release the carton blank onto the conveyor 14. As the cam is rotated the roller is pushed to the right as viewed in FIG. 3, pivoting the lever 87, pushing the connecting rod 89 to the left, and opening the vacuum valve to apply a continuous vacuum head to the suction cups by linking the hose line 93 with the vacuum line 96 through the passage 95. This vacuum pressure in the suction cups will continue until the cam 78 is rotated almost one full cycle, causing the cam roller 86 to re-enter the oblate portion of the groove 85 to move the piston 92 and thereby move the passage 95, out of communication with the vacuum source.

Another feature of the present invention resides in the manner in which the conveyor and end flap manipulating apparatus 13 bring the cartons into the filling position and cooperate with the above described feeder mechanism to maintain the cartons in their erected condition and spaced arrangement. The conveyor 14 which propels the cartons horizontally along the support structure 17 has been described as including the endless chain 82 which is supported at one of its ends by the sprocket 81 fixed to shaft 80, the latter being journalled in the machine frame. The other end of the conveyor chain 82 is supported by a drive sprocket at the closing station end of the cartoning machine 10, such structure forming no part of the present invention and not being shown in the drawings. The conveyor chain 82 is of the standard connected link type and, in addition, it is provided with a plurality of equally spaced projecting lugs 93 which are adapted to engage the erected carton blanks and propel them along the supporting structure 17. The conveyor chain is driven at a speed which is related to the speed of the feed mechanism 11 so that one carton will be placed upon the conveyor between each pair of projecting lugs; the lugs, therefore, function as spacing means for the cartons.

Referring now particularly to FIGS. 5 and 6, a further significant feature is provided in the end flap manipulating members which receive the cartons from the feeder and prepare their end flaps and tabs for the filling operation. Each carton is guided on its downward path from the magazine 12 by a pair of upwardly flared guide members 101 and 102. Positioned between the guide members to catch the upper end flaps of the carton are support members 103 and 104. These support members extend parallel to the conveyor 14 and are mounted upon inwardly extending opposed flanges 106 and 107, respectively, on the support structure 17. Each of the support members is provided with a bowed section 108, 109 at its discharge, or downstream end portion, as is illustrated clearly in FIGS. 5A and 6A. The concave faces of the bowed sections 108 and 109 face inward, toward each other, as shown in FIGS. 5 and 6. The support members 103 and 104 transfer the carton to a rectangular mandrel 111 (FIGS. 5 and 5A) which receives one end of the carton, and a shelf 114 which carries the other end of the carton. As shown in FIG. 5A, the rectangular mandrel has a horizontal upper face 112 and a vertical, inwardly facing forming surface 113, and is cut away at its end portion to expose a rounded camming edge 116 to receive and cam downwardly the lower end flap on one end of the carton. The mandrel 111 is mounted upon the flanges 106 by support structure 117 so that it is elevated slightly above the flange to expose a slot 118 between its lower surface and the upwardly curved inner edge of flange 106. As best seen in FIG. 6A, the support shelf 114 is mounted upon the flange 107 by support structure 121 so that it, too, is elevated above the flange to expose a slot 122 facing the interior of the machine. The bowed section 109 on the support member 104 is progressively widened to its end portion where its lower edge 123 projects downward toward the support shelf 114 and outwardly so as to direct the carton flap sliding therebeneath into the slot 122.

Another feature of the present invention is the specific shape of the suction cups 59 which are used to grip the carton blanks and transfer them to the conveyor. A primary concern in designing such cups is with their ability to respond quickly so as to allow for as rapid an over-all feeding operation as possible. In accordance with this aspect the suction cups have been designed so as to provide a high pulling power per over-all cup area. This, in turn, may provide for a sufficient force to hold the blanks upon the cups by using a less than normal over-all cup area, the latter condition fostering rapid action by permitting a vacuum to be achieved within the cup very rapidly as it is pressed against the blank.

Suction cups in use today are typically provided with a relatively wide annular flange which increases in thickness as it extends inwardly toward the center of the cup. This flange also usually includes an outwardly curved gripping surface so as to form a semi-spherical chamber within the outer rim of the cup in its unstressed condition, the inner portion of which is provided with some type of tubular inlet means communicating with a vacuum source. When the cup is pressed against a flat article for lifting and transferring purposes, the flange is flattened to a considerable extent. This deformation of the flange, therefore, significantly affects the area over which the vacuum pressure is applied, at times limiting such area to the cross-sectional area of the vacuum source inlet means when the flange is completely flattened, thereby greatly reducing the force which holds the article to the suction cup.

In accordance with the present invention the flange which is adapted to grip and be flattened upon the flat article received by the cup is a relatively thin flange of substantially constant width and being highly flexible. This flange, which is narrow in over-all length as compared to the large flanges of the typical above-described suction cups, is adapted to readily flatten out and apply an annular seal while the relatively thick body portion of the cup, which includes a semi-spherical vacuum applying chamber, is substantially non-depressible. Thus, the same vacuum applying area is pressed against the article each time the suction cup is used, and a maximum suction force between the article and the cup is obtained.

FIGS. 10 and 11 show in detail the structure of the cup. This structure includes a relatively thick body portion 131 and a relatively thin annular flange 132 which projects from the outer circumference of the body portion. The shape of this flange is of importance. It is to be noted that the flange is formed with substantially constant thickness and is adapted to readily bend about the depression 133 in the outer surface of the cup to flatten against the engaged article. The flange includes a surface 134 which is the only surface adapted to engage the article.

The relatively thick body portion 131 includes a rear hub portion 134 and a central passage 135. When the suction cup is installed for operation the hub may be used for mounting the cup and the passage connected to a vacuum line. The passage opens into a semi-spherical chamber 136 which is defined by a concave surface 137 and the flange 132. When the suction cup is applied (FIG. 11), the flexible flange is bent back until the sealing surface 134 is lying flat against the article to be picked up and the chamber 136 is contiguous with the flat face of the article. The body portion 131 is of such thickness relative to the flange 134 that it does not deform to any extent without a considerable increase in application force. It can thus be seen that each time the cup is applied against a carton blank or other flat object, only a relatively small application pressure is needed to flatten the flange and assure a good vacuum seal, and a relatively large gripping force is obtained as the area of the

vacuum chamber **136** against the carton is quite large with respect to the over-all dimensions of the cup. This increase in pulling power due to the relatively large vacuum applying area creates an increase in resistance to lateral forces which would displace the article from the cup.

By way of example and to illustrate the relation between the various parts of the cup structure, a suction cup made in accordance with the invention might include the following dimensions. With a radius of ½ inch describing the outer surface of the body portion **131**, the spherical surface **137** of the vacuum chamber **136** could be formed about a radius of $1\frac{5}{16}$ inches. The flange **132** should then have a length of about ⅛ inch (measured radially of the cup) and a thickness of $\frac{1}{32}$ inch. The passage **135** should then be approximately $\frac{3}{16}$ inch and the over-all height of the cup (in unstressed condition) will be approximately ½ inch. The flange should project at an angle of 30° from the plane of the mouth of the vacuum chamber **136** for optimum results. With such relative dimensions, neoprene rubber with a Durometer 45 hardness, as measured with Shore Scale A, is suitable for use in molding the cup.

The method of attaching the suction cup to a vacuum line fitting may vary, but a typical method might include inserting a tubular fitting through the access passage **135** which would contain abutment flanges spaced so as to engage the cup within the chamber **136** and at the rear of the cup against the hub **134**, thus retaining the tubular fitting within the access passage. The fitting would then be connected to a vacuum hose line which would provide the vacuum chamber **136** with the necessary vacuum pressure.

Some of the important features of the suction cup **59** include the body portion **131** which is designed so as to remain rigid or non-deformable during operation; the narrow annular flexible rim **132** which is readily deformable so as to reduce the amount of application force necessary to assure a good seal; and the substantially non-changeable vacuum chamber **136** which will always apply the same total gripping force to the object picked up, which force will be large in consideration of the over-all dimensions of the cup.

The advantages of such construction are many. They include the greater pulling power of the cup for its relative size due to the short length of the sealing flange and the non-deformable character of the body section. Also, the suction cup will obtain quick action in applying a gripping force to the article engaged because the flange **132** readily flattens to seal the vacuum chamber **136**. This means less pressure needed against the blank and less give in a yieldable stack of blanks when the suction cup is applied thereto to remove the lead one. The result of these advantages is a quick-action suction cup with positive gripping action which is particularly adaptable for a high speed transfer operation.

The operation of the apparatus will be described with reference to the carton blank **20** which has been described above, although it is to be understood that such carton structure may be modified and a variety of other specific carton shapes may be used with the subject carton handling apparatus within the scope of the present invention. As best seen in FIG. 5, the cartons are stacked within the magazine **12**, each resting upon one of its lateral edges with the top panel **21** and the side panel **23** facing forwardly toward the feeder mechanism **11**.

At the beginning of the cycle of operation, the feeder mechanism **11** is in the elevated position with the suction cups **59** engaging the top panel **21** of the foremost carton blank in the magazine **12** and the erector fingers **71** generally extended in alignment with the bracket **58**, as seen in FIG. 7. In this position the oscillating connecting rod **75** is in its uppermost position and the cam roller **86** is engaged in the semi-circular portion of the camming groove **85** to maintain the vacuum valve **91** in the open position thereby applying vacuum to the suction cups through their hose connections **93***a*, **93***b* and **93***c*.

As the driven shaft **77** is rotated the connecting rod **75** is pulled downwardly, thus causing the carrier plate **52** to pivot about the axis of the shaft **51** pulling the suction cups **59** and their carrier bracket **58** away from the magazine **12** in a clockwise rotational movement, as viewed in FIG. 3. This pivoting movement of the carrier plate additionally causes the bell crank **62** to pivot the channel **61** in the opposite direction and rotate the housing **54** to rotate the suction cup bracket and the carton blank with which it is engaged toward the conveyor in a counterclockwise rotational movement.

FIG. 8 illustrates an intermediate position as the carton blank is moving from the magazine to the conveyor, and particularly indicates the action of the erector fingers **71**. As the bracket **58** is swung about the hub **66**, the relationship between the end of the bracket, including the housing **70**, rotatably mounting the fingers and the eccentric mounting of the rod **67** on the hub is changed so that the rod **67** moves relatively to the bracket to pivot the fingers. This pivoting motion of the fingers causes them to bear against the side panel **23** of the carton and turn it forwardly about the pre-formed score line which separates it from the top panel **21**. Such action serves to erect the carton blank, i.e., open it into the form of a carton, as is apparent from FIG. 8.

When the connecting rod **75** reaches its lowermost position, as seen in FIG. 4, the suction cup bracket **58** has been swung into a position parallel to and overlying the conveyor **14**. At this time, as previously explained, the cam roller **86** is received in the oblate portion of the camming groove to pivot the lever **87** and open the vacuum valve **91**, causing the hose line **93** which communicates with the suction cups to be vented to atmospheric pressure thereby destroying the vacuum and releasing the carton (FIG. 3). The position of the fingers **71** is approximately perpendicular to the plane of the suction-cup bracket **58** so as to fully bring the top, bottom and side panels into 90° angularity with each other, as can be seen in FIG. 9.

When the feeder mechanism has reached the above-described lowermost position of the suction-cup bracket, continued rotation of the drive shaft **77** causes the connecting rod **75** to be pushed in the opposite direction to pivot the suction-cup bracket back into the FIG. 7 position to receive the next carton blank from the magazine. As the bracket is moved away from its position overlying the conveyor, the vacuum valve **91** acts to create a vacuum force within the suction cups which will remain for almost a complete cycle until the bracket is once more moved to the conveyor.

The descending carton blank which has been released from the feeder mechanism **11** is guided by the guide members **101** and **102** until it reaches the support members **103** and **104** which catch the upper end flaps **25** and **27**, respectively. As pointed out, the upper end flaps **25** and **27** are wider than the lower flaps **26** and **28**, a factor which allows the lower flaps to clear the projecting edges of the support members as the carton falls into position. The support members thus support the carton only by its upper end flaps **26** and **27** so that the bottom panel **22** of the carton is free for separate manipulation. This bottom panel is engaged at its trailing edge and urged forwardly with respect to the top panel by a projecting lug **98** on the conveyor chain to retain the carton in the rectangular shape.

As the carton is pushed forwardly along the support members **103** and **104**, it is received upon the bowed sections **108**, **109** of such members which further aid in readying the carton for filling. The bowed section **108** (FIGS. 5, 5A) allows the upper edge of the support member to be worked under the upper end flap **27** to a position where the retarding friction upon this upper

flap aids in holding the carton in its rectangular form, since one of the lugs **98** on the conveyor exerts its propelling force against the trailing side panel **23** adjacent its lower edge. The bowed section **109** (FIGS. 6 and 6A) performs this same function at the other end of the carton by frictionally engaging the upper end flap **25**. In addition, the bowed section **109** bends the associated upper end flap slightly upward and the associated lower end flap **26** slightly downward by being received between the flaps. This forces the flaps apart, and thereby makes the filling of the carton simpler.

The support member **103** transfers its associated end of the carton from the bowed section **108** to the rectangular forming mandrel **111**, the horizontal upper face **112** of which frictionally engages the upper end flap **27**, while the vertical forming surface **113** forces the lead end tab **32** inwardly and the trailing end tab outwardly. The vertical surface **113** also serves as a backstop for articles inserted into the carton. The camming edge **116** (FIG. 5A) strikes the lower end flap **28** and cams it into the slot **118** so that the associated end of the carton will ride along the forming surface **113** of the mandrel.

The other end of the carton is made ready for the filling operation to be performed at the filling station **16**. The lower end flap **26** is directed by the bowed portion **109** into the slot **122**. The remainder of this end of the carton rides along the support shelf **114** in a position wherein articles may be easily slid from the shelf into the carton. Because of the snug fit of the carton between the vertical surface **113** and the inner edge of the shelf **114** and because of the frictional drag on the upper end flap **27**, which cause the respective pushing lug **98** to square up the carton, the carton is maintained in a true rectangular form as it is conveyed into and past the filling station **16**.

Upon filling, the carton continues to be propelled along the conveyor to the closing station where the end tabs and the end flaps of the carton are closed and locked in a manner not within the scope of the present invention.

From the foregoing description it is apparent that the structure of the present invention presents a rapid action oscillating carton feeder which performs the dual operation of feeding cartons from a stack to a continuously moving conveyor and erecting the blanks into hollow tubular form for filling. In addition, the conveyor and its associated structure cooperate with the feeder and opener mechanism in retaining the carton in erected condition ready for filling.

While one embodiment of the present invention has been shown and described, it will be understood that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

The invention having thus been described what is believed to be new and desired to be protected by Letters Patent is:

1. A carton feeding mechanism comprising a bracket, a suction cup mounted on said bracket and having a mouth for gripping a collapsed tubular carton blank, a shaft for mounting the bracket, means for oscillating the bracket about said shaft between a carton blank engaging position and a carton blank releasing position, folding means pivotally mounted on said bracket adjacent one end thereof and adapted to be substantially aligned with the plane of the mouth of said suction cup in said engaging position, and a rgid member pivotally connected to said shaft and to said folding means for pivoting the folding means as said bracket is oscillated about the shaft so as to reduce the angle between the folding means and said plane to erect said carton blank by pivoting one section thereof away from the suction cup and with respect to a second section engaged by said suction cup, said sections being at an approximate right angle to each other at said releasing position.

2. A carton feeding mechanism comprising a bracket, a suction cup mounted on said bracket and having a mouth for gripping a collapsed tubular carton blank, a shaft for mounting the bracket, means for oscillating the bracket about said shaft between a carton blank engaging position and a carton blank releasing position, a pivotally mounted plate for mounting said shaft, means for oscillating the plate, folding means pivotally mounted on said bracket adjacent one end thereof and adapted to be substantially aligned with the plane of the mouth of said suction cup in said engaging position, and a rigid member pivotally connected to said shaft and to said folding means for pivoting the folding means as said plate and said bracket are oscillated so as to reduce the angle between the folding means and said plane to erect said carton blank by pivoting one section thereof away from the suction cup and relatively to a second section engaged by said suction cup, said sections being at an approximate right angle to each other at said releasing position.

3. A method of preparing a tubular carton for filling comprising the steps of gripping a collapsed tubular carton blank by a first section thereof, transferring said carton blank to a conveyor and simultaneously turning an adjacent coplanar second section of the blank out of coplanar alignment with said first section thereof to erect the blank into the form of a tubular carton, depositing the carton upon a conveyor for movement to a filling area, slidably frictionally engaging said first section and urging said second section with said conveyor so as to impose oppositely directed forces on said second section during travel of the carton to maintain the second section erect, propelling one tubular end of the carton along a flat faced mandrel and simultaneously propelling the other tubular end of the carton adjacent a shelf with the bottom side of said other tubular end in substantial alignment with the top surface of said shelf whereby articles with which the carton is to be filled may be slid from the shelf into the carton and retained therein by said mandrel.

4. Carton handling apparatus comprising means for erecting a collapsed tubular carton blank into the erect tubular carton shape by turning a first section of the blank out of coplanar alignment with a second section thereof and into an approximate right angle therewith while transferring said carton blank from a stack, a pair of support members for engaging and horizontally supporting said second section at its opposite ends upon release of said carton blank from said first-named means, and a moving conveyor arranged between said support members and having a plurality of spaced lugs thereon for engaging said first section to propel said blank along said support member, the spacing between said lugs being substantially greater than the distance across said second section of the carton blank with only the frictional engagement of said support members with said second section and the engaging force of said projection against said first section cooperaitng to maintain the blank in said erect tubular carton shape.

5. A method of preparing a tubular carton for filling according to claim 3 wherein said other tubular end of the carton is passed along a member extending parallel to said conveyor and thereby subjected to a camming action resulting in the end of said first section thereof being bent upwardly so as to facilitate the filling of the carton when it is thereafter propelled adjacent said shelf.

6. Carton handling apparatus comprising means for gripping a collapsed tubular carton blank from a stack and for erecting said blank into a tubular carton shape by turning a first section of the blank out of coplanar alignment with a second section thereof and into an approximate right angle therewith while simultaneously moving said carton blank from the stack to a lower position wherein it is released, a conveyor arranged beneath said first named means for receiving the carton blank, a pair of support members arranged adjacent and parallel to

said conveyor on either side thereof for engaging and horizontally supporting said second section of the carton blank at its oposite ends, said conveyor having a plurality of spaced lugs thereon projecting upwardly to engage said first section of the carton blank to propel said blank along said support members, the spacing between said lugs being substantially greater than the distance across said second section of the carton blank, one of said support members having a gradually widening shape as said blank is propelled along said conveyor so as to bend upwardly the uppermost section at one of said supported ends of said second section of the carton blank, and a flat-faced mandrel and flat shelf located on opposite sides of said conveyor downstream of said supporting members, said one end of the carton blank being propelled alongside said shelf while the other end of said carton blank is propelled along said flat-faced mandrel whereby articles may be slid from the shelf into the carton and retained therein by said mandrel.

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