Sept. 22, 1959 C. E. KERR 2,904,945

CARTON FILLING APPARATUS

Filed May 26, 1955 6 Sheets-Sheet 1

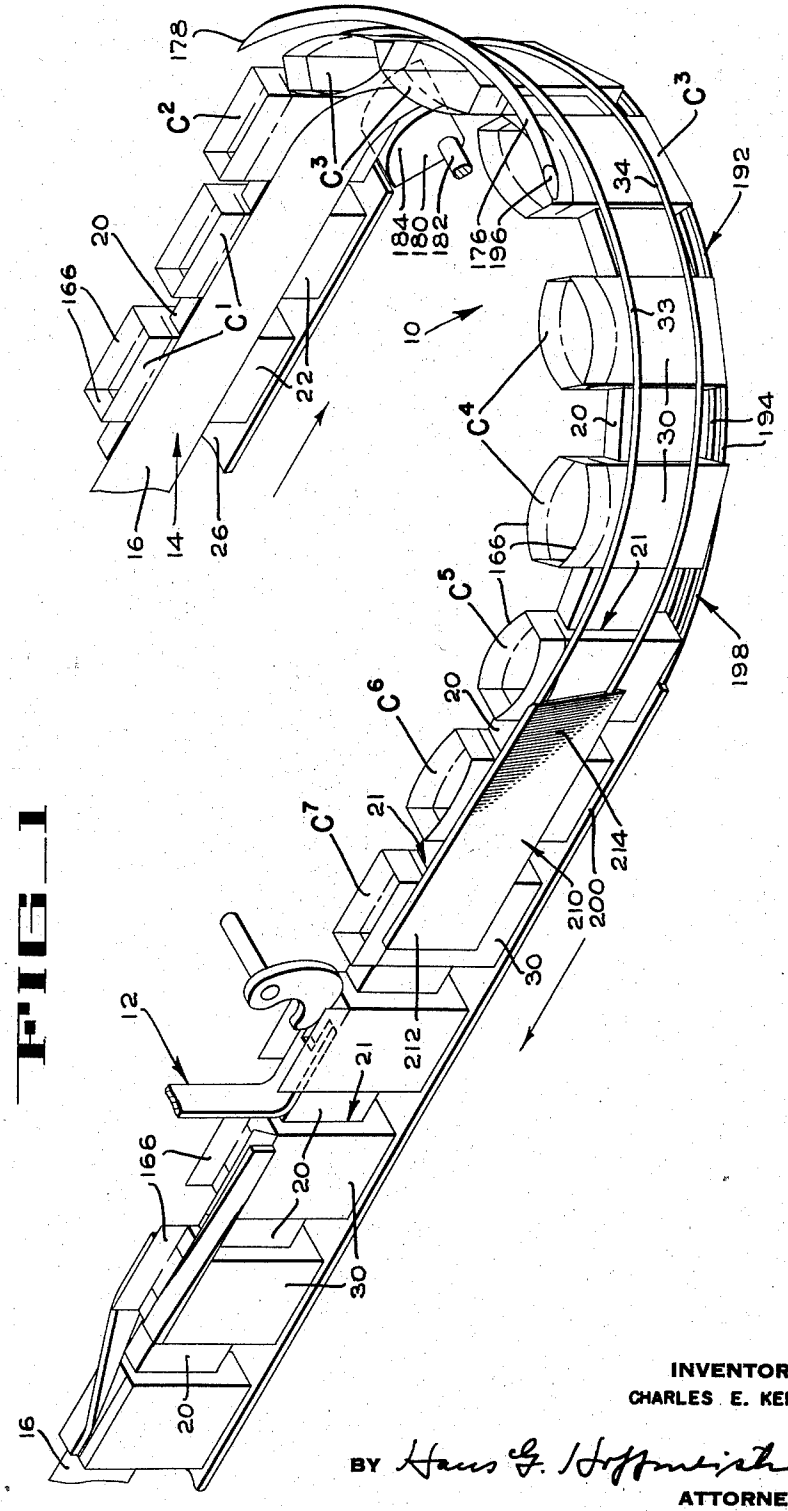


FIG. 1

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6 Sheets-Sheet 2

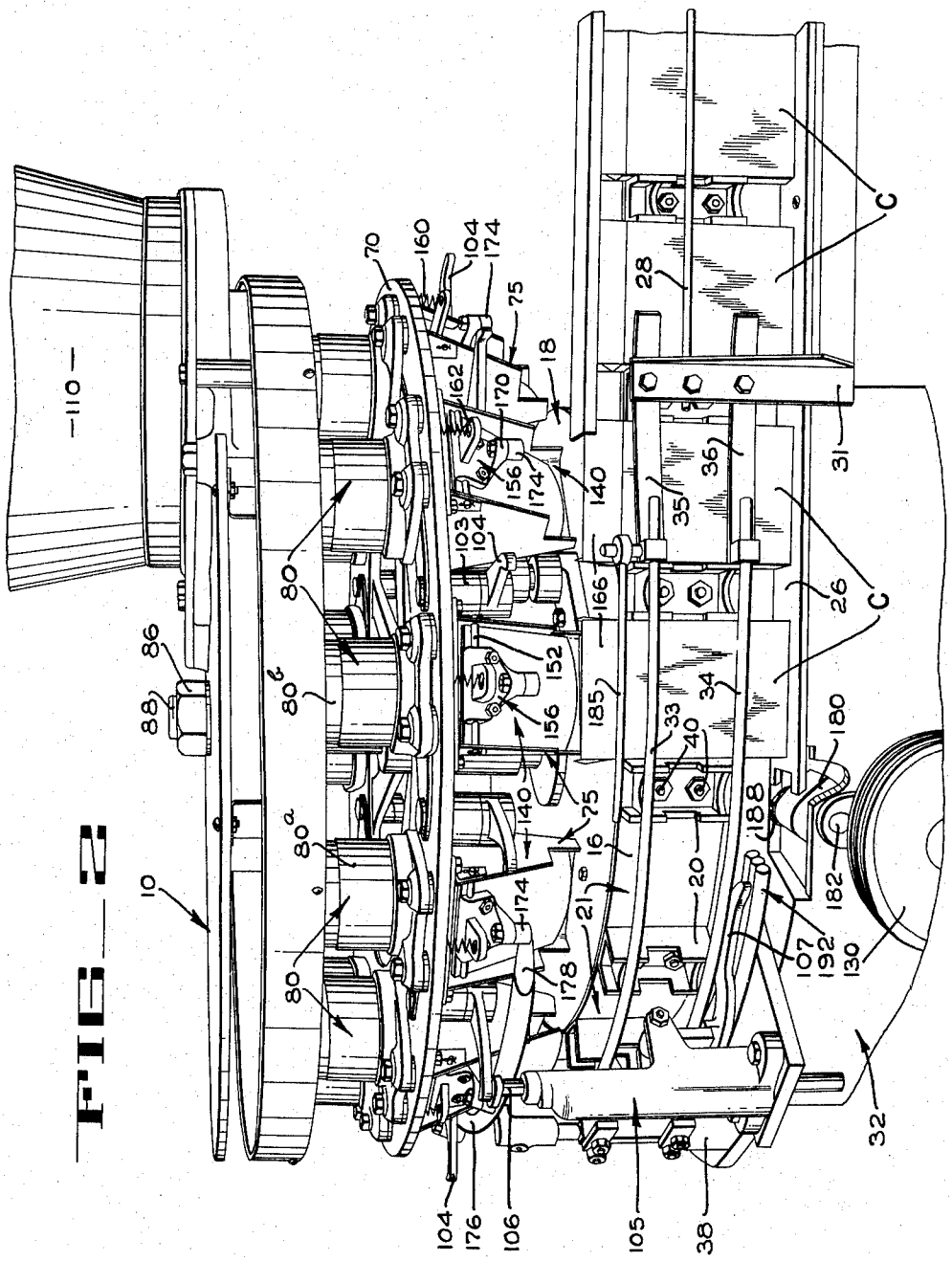


FIG. 2

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CARTON FILLING APPARATUS

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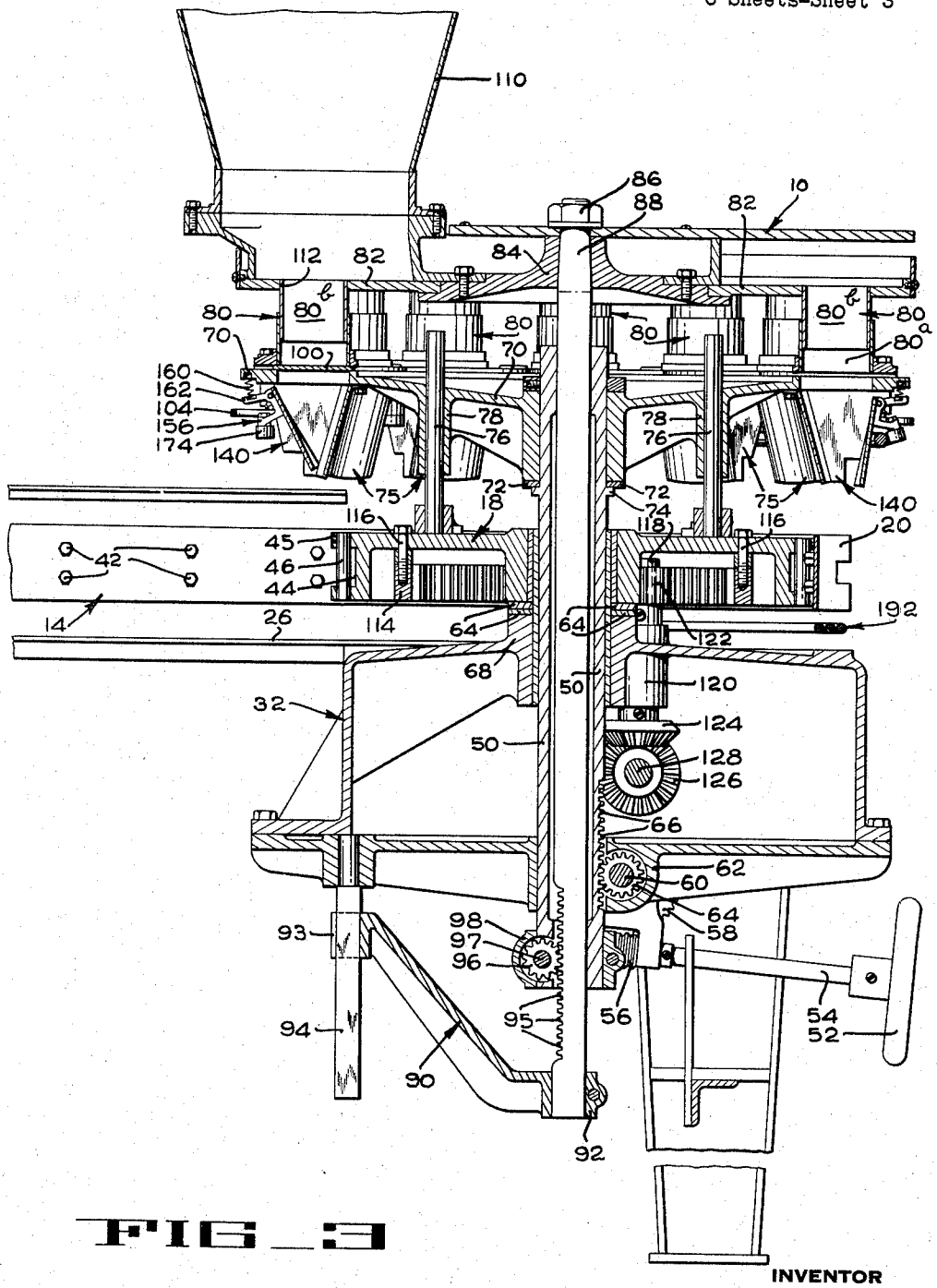


FIG_3

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CARTON FILLING APPARATUS

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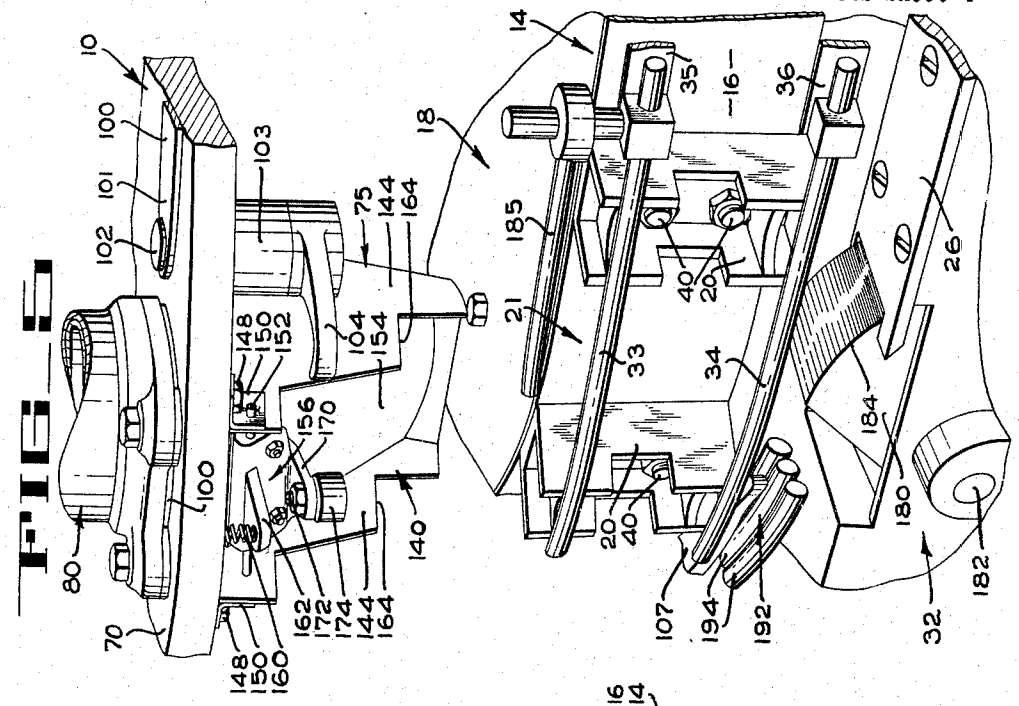


FIG. 5

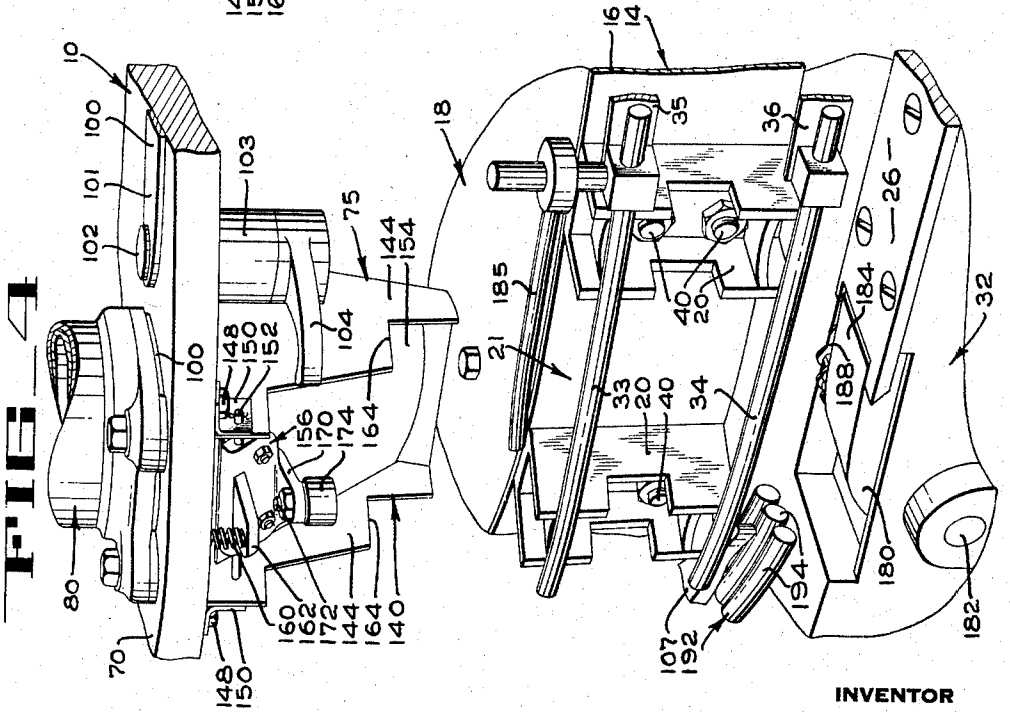


FIG. 4

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CARTON FILLING APPARATUS

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FIG 8

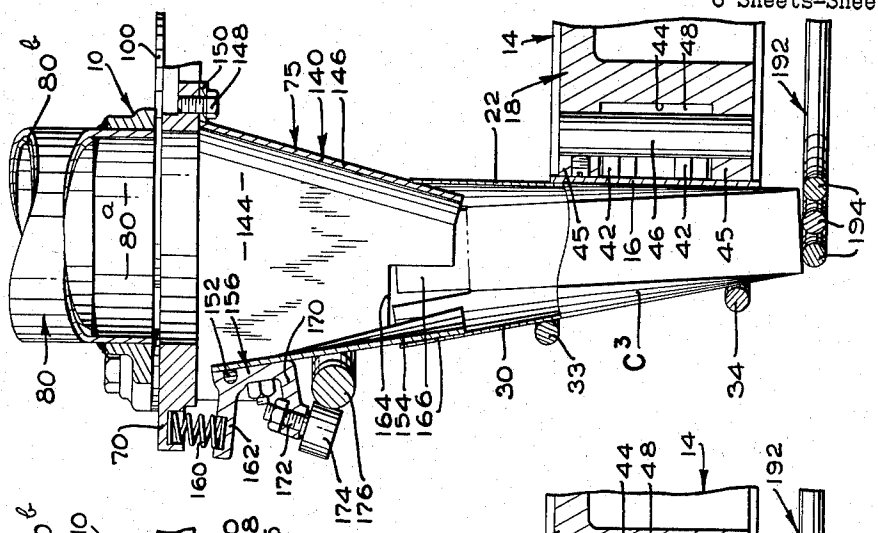


FIG 7

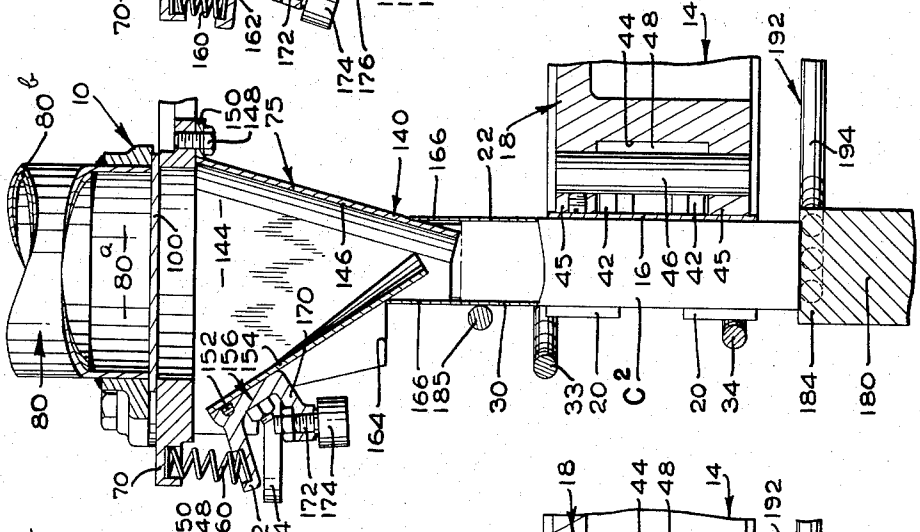
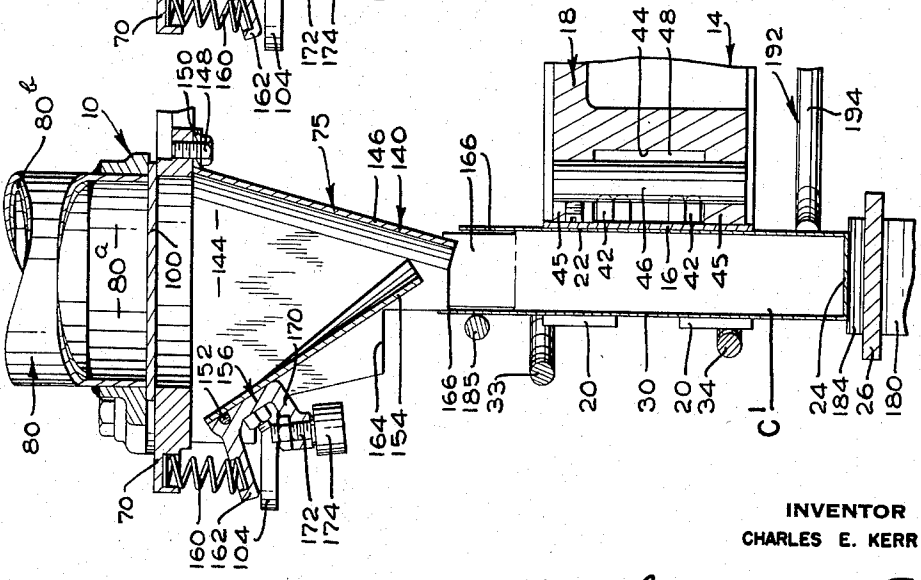


FIG 6



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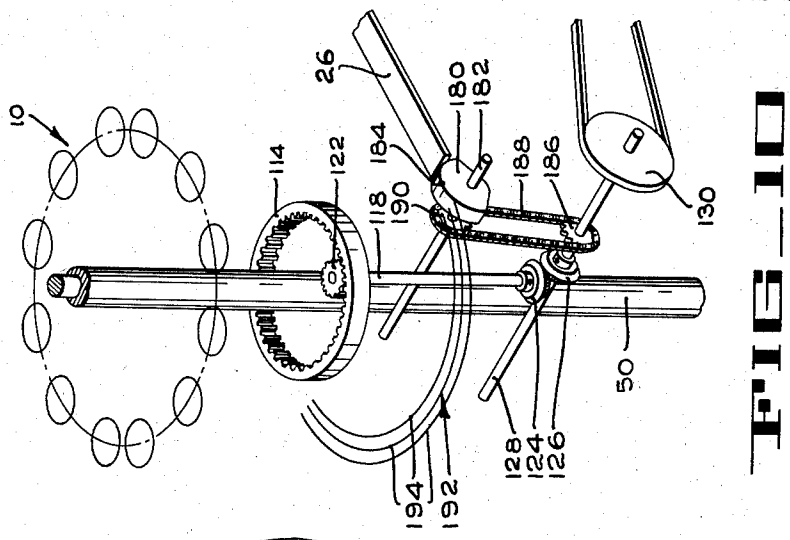


FIG. 10

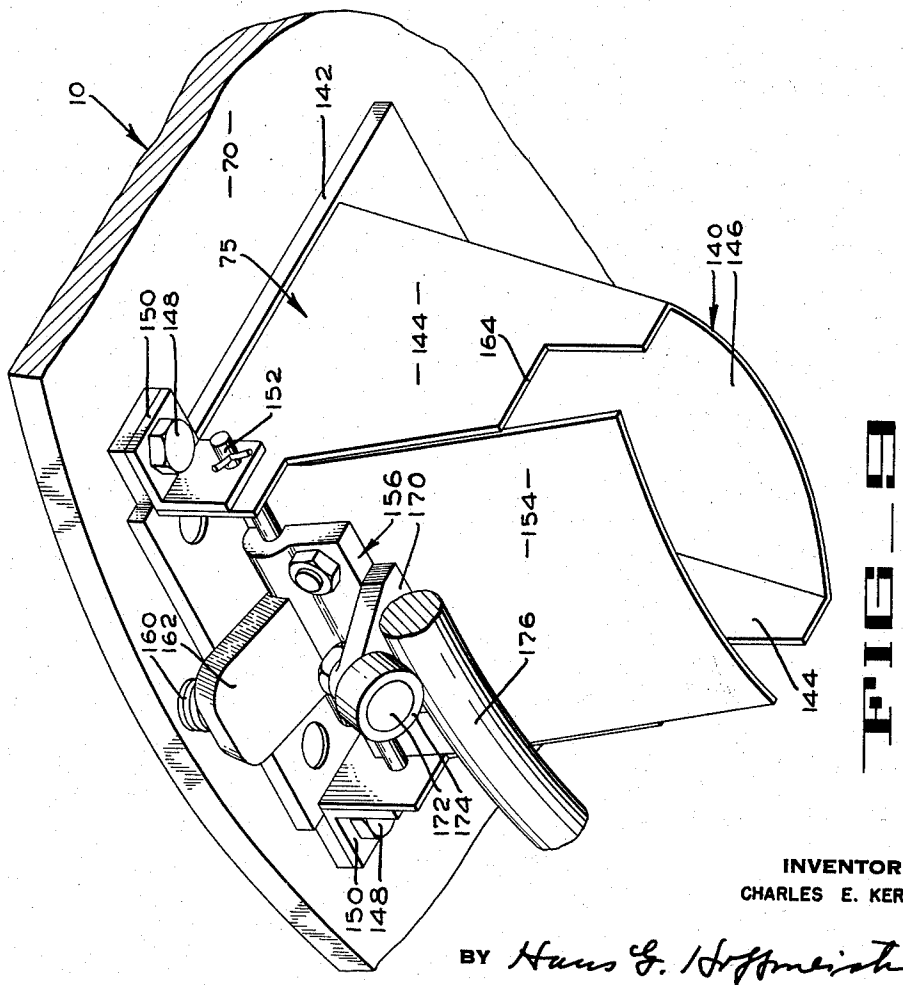


FIG. 9

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Patented Sept. 22, 1959

2,904,945

CARTON FILLING APPARATUS

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Application May 26, 1955, Serial No. 511,349

7 Claims. (Cl. 53—124)

This invention relates to carton filling methods and machines.

An object of the invention is to provide an improved method of filling cartons with granular material or with material consisting of small solids, such as shelled peas or beans.

Another object is to provide a novel method of filling cartons, which is particularly adapted for use in the food processing industry in preparing peas, beans, and like commodities for freezing.

Another object is to provide a method of filling cartons whereby the time required for freezing the filled cartons is minimized.

Another object is to provide a packaging method capable of effecting a substantial saving in the cost of cartons by causing the commodity to be snugly, or tightly packed within the cartons, thereby permitting the use of cartons of minimum dimensions to pacakge given quantities of the commodity.

Another object is to provide a practical and efficient apparatus for performing the method of the invention.

Another object is to provide a novel filling spout for a carton filling machine.

Another object of the invention is to provide a spout for use in connection with a carton filling machine, whereby measured quantities of bulk material can be funnelled into cartons at an increased rate and with less tendency for the flow of material to be obstructed by choking or bridging within the filling spout.

Another object is to provide a filling spout adapted to feed a measured quantity of loosely packed bulk material into a carton in such a manner that the material, when later compacted to a more dense condition, will closely correspond in volume to the capacity of the closed carton.

Another object in this connection is to provide a filling spout that is adapted to deform, or distend an empty carton, and thereby to temporarily increase the volumetric capacity of the same, thus permitting loosely packed bulk material to be fed into the carton in such quantities that when the carton is returned to its normal configuration and closed, the material will fill the carton snugly in spite of having been compacted to a more dense condition.

Other objects and advantages of the invention will become apparent from the following description and drawings in which:

Fig. 1 is a perspective schematic illustration of apparatus for performing the method of the present invention.

Fig. 2 is a perspective of the carton filling machine constituting one unit of the apparatus of Fig. 1, certain parts being broken away.

Fig. 3 is a vertical, medial section through the carton filling machine of Fig. 2.

Fig. 4 is a fragmentary perspective illustrating one of the carton-receiving pockets of the machine shown in Figs. 2 and 3, and the filling spout associated with the pocket.

Fig. 5 is a view similar to Fig. 4 showing the pocket and filling spout in a latter phase of their cycle of operation.

Fig. 6 is a vertical section taken radially of the filling machine through a filling spout and a carton-receiving pocket thereof and through an empty carton seated within the pocket, showing the parts in the positions assumed thereby a brief interval later than when in the positions thereof illustrated in Fig. 4.

Fig. 7 is a view similar to Fig. 6 but showing the parts substantially in the phase of their operational cycle illustrated in Fig. 5.

Fig. 8 is another view similar to Fig. 6 but showing the parts in a still later phase of their operational cycle.

Fig. 9 is an enlarged perspective of one of the filling spouts of the machine of Figs. 2 and 3, viewed from below.

Fig. 10 is a diagram of the drive for the rotary table of the carton filling machine and the drive for the cam whereby cartons are elevated into position to receive material from the filling spouts.

In the frozen food processing industry, it is advantageous to package the commodities to be frozen in relatively shallow cartons, because of the greater rapidity with which heat can be extracted from a shallow package as compared with one whose geometric center is spaced at a greater distance from the nearest bounding wall. It is common practice to pack foods to be frozen in shallow cartons of the hinged-lid type, whose large opening permits rapid loading, and whose hinged lid, when closed by a pivoting pressure plate, presses the contents of the carton to an evenly distributed and densely packed condition free of voids. Such a condition of the contents of a package is most conducive to rapid freezing and consequent preservation of prime quality of the food, as well as shortening of the period during which the package must remain in the freezing chamber.

However, cartons of the end-fill type are less expensive to produce and are capable of being handled more expeditiously and with simpler and less expensive equipment than hinged-lid cartons. Therefore, shallow, end-fill cartons would be more nearly universally adopted for packaging for freezing such food items as peas and beans were it not for the difficulty of rapidly funnelling the requisite quantity of the commodity through the restricted end opening of such a carton. Another disadvantage inherent in shallow, end-fill, rectangular cartons is that a carton of such a type cannot receive the same quantity of a bulk material as a round, or cylindrical carton of the same volumetric capacity without agitation or tamping of the material during and following introduction of the material to the carton. Since such compacting of the contents of a carton necessitates substantial lengthening of the filling time and is apt to impair the quality of the finished product, the customary present practice is to employ oversized cartons. This results in a loose package, i.e., a package whose contents are so loosely compacted that the particles constituting the contents do not bear against each other with sufficient pressure to promote rapid flow of heat between particles. Moreover, the contents do not completely fill the closed carton with the result that voids, or dead air spaces, remain within the carton. A package of this nature is characterized by such a low co-efficient heat conductivity that the period required for freezing thereof is seriously prolonged.

The present invention overcomes these disadvantages of an end-fill, shallow rectangular carton by employing a filling spout which deforms such a carton to a condition more nearly approximating a cylindrical configuration. By changing of the shape of the end opening of the carton from a relatively long and narrow rectangle to

one having the same perimeter but which is only slightly shorter and the sides of which are bowed outward, the area of the opening can be increased by as much as 25 percent. Such an increase in the area of the opening of a carton makes possible a substantial increase in the rate at which material can be fed into the carton without clogging or bridging, and a corresponding reduction of the carton's filling time. Of even more importance, however, is the temporary increase in volumetric capacity of the carton resulting from an increase in the area of an end of the carton without any appreciable reduction in the carton's length. As a consequence, material can be introduced to the distended carton in a loosely packed condition but in a quantity sufficiently in excess of the carton's normal capacity to insure completely filling the carton when the material is later compacted to a more dense condition and the carton is closed. Therefore, when cartons are filled by means of the apparatus and according to the method of the present invention not only can a substantial economy be attained by employing a smaller carton to contain a given quantity of material, but a densely compacted package free of voids is produced, thus making for maximum freezing efficiency.

Referring now to the drawings, Fig. 1 schematically illustrates a carton feeding, filling and closing system including a rotary carton filling machine **10** and a carton closing machine **12** to and through which cartons C are carried in a continuous, rapidly advancing procession, by a conveyor **14**. The conveyor **14** comprises a flexible belt **16** (Figs. 1, 2 and 3) which conveniently may be of stainless steel and which is disposed with its transverse dimension extending vertically. The belt **16** is trained around a driving wheel or pulley **18** (Fig. 3) that constitutes the rotary table of the filling machine **10**. Blocks **20** (Figs. 2 and 3) are secured to the belt **16** at equally spaced intervals along the same, which intervals are but slightly greater than the width of the cartons C to be filled. Hence, the blocks **20** cooperate with the belt **16** in defining pockets **21** each of which is adapted to receive a single carton C with one wall **22** (Figs. 6, 7 and 8) facing inward toward the belt **16** and with the bottom **24** (Fig. 6) of the carton slidably supported on a horizontally extending stationary plate **26** (Figs. 2 and 6). A guide rod **28** (Fig. 2) is mounted in position to slidably engage the outwardly facing walls **30** of the cartons to prevent outward displacement of the cartons C from the pockets **21** as the cartons are carried toward the filling machine **10** on the conveyor **14**. The guide rod **28** terminates at a point somewhat in advance of the position where it would become perpendicular to a radius of the rotary table **18**, and the terminal end of the guide rod **28** is supported by a bracket **31** that is rigid with the frame **32** of the filling machine **10**.

The bracket **31** likewise provides support for a pair of vertically spaced, substantially arcuate guide rods **33** and **34** (Fig. 2) which are secured to the bracket **31** by upper and lower strips **35** and **36**, respectively. The guide rods **33** and **34** extend circumferentially of the filling machine **10** in a position spaced radially outward from the rotary table **18** to accommodate a carton C in each pocket **21** and thus to prevent displacement of the cartons from the pockets during their progress through the filling machine **10**. The ends of the guide rods **33** and **34** first engaged by a carton C are offset from vertical alignment, the upper rod **33** being at a greater radial distance from the belt **16** than the lower rod **34**, as best shown in Figs. 6, 7 and 8. Additional support is provided for the guide rods **33** and **34** at spaced intervals therealong by a plurality of posts **38** (Fig. 2) only one of which is shown.

The blocks **20** are secured to the belt **16** by bolts **40** (Figs. 2, 4 and 5) whose heads **42** (Figs. 3, 6, 7 and 8) protrude beyond the inner face of the belt **16** so that each bolt head **42** extends into an annular channel **44** in the periphery of the rotary table **18** when the adjacent portion of the belt **16** engages the rotary table. The channel **44** is defined by spaced annular flanges **45** of the table **18**, and pins **46** carried by the flanges **45** and extending across the channel **44**, divide the channel into circumferentially spaced pockets **48** adapted to receive the bolt heads **42** and thereby assure that the belt **16** is positively driven by the rotary table **18**. In this manner, the belt **16** is retained in such relation to the rotary table **18** that the conveyor pockets **21** advance in suitably timed and positioned relation to the carton filling machine **10**.

As shown in Fig. 3, the table **18** is rotatable about a vertical, tubular column **50** supported from the frame **32** of the filling machine **10**. Although the column **50** is secured against rotation with respect to the frame **32**, by a suitable spline connection (not shown), the column **50** is vertically adjustable by a hand wheel **52** accessible at one side of the frame **32** and connected by a shaft **54** to a worm **56**. This worm **56** is enmeshed with a worm wheel **58** affixed to a shaft **60** suitably journaled in a boss **62** on the underside of the frame **32**. Also affixed to the shaft **60** is a pinion **64** enmeshed with rack teeth **66** on the column **50**, with the result that the column **50** can be raised and lowered by turning the hand wheel **52**. Such adjustment of the column **52** has no effect on the table **18**, since the column is freely slidable through the table **18**. The table **18** is supported for rotation with respect to the column **50** by thrust-bearing rings **64** the lowermost of which rests upon a central boss **68** upstanding from the frame **32**.

An upper head **70** is carried by the column **50** for vertical adjustment in response to raising or lowering thereof. The head **70** is freely rotatable with respect to the column **50**, since it is supported above the rotary table **18** by a thrust-bearing ring **72** resting upon a shoulder **74** formed on the column. The head **70** carries a plurality of filling spouts **75** suspended in a circular series from its lower side. The head **70** is connected to the table **18** for rotation therewith, and for vertical adjustment with respect thereto, by a plurality of pins **76** rigid with and extending upward from the table **18** and extending slidably through tubular guides **78** integral with and extending downward from the head **70**. Such vertical adjustment of the head **70** adapts the filling machine to fill cartons of different heights, since it varies the elevation of the carton filling spouts **75** without changing the height of the carton supporting members, to be described later herein.

The filling machine **10** is provided with a plurality of telescopic measuring cups **80** (Figs. 2 and 3), each of which is in cooperative association with one of the filling spouts **75**. The lower tubular portions **80***a* of the measuring cups **80** are carried by the head **70**, while the upper tubular portions **80***b* of the measuring cups **80** fits slidably within the lower portions **80***a* and are carried by an annular plate **82**. The inner periphery of the annular plate **82** is slidably supported upon a second head **84** rigidly secured by a nut **86** upon the tapered upper end of a central post **88** above the upper end of the column **50**. The post **88** extends through the column **50** and is axially slidable with respect to the same, but is prevented from rotating by an arm **90** whose inner end **92** is clamped rigidly to the lower end of the post **88** and whose bifurcated outer end **93** slidably embraces a guide pin **94** affixed to and extending downward from the underside of the frame **32**. Rack teeth **95** on the post **88** are engaged by a pinion **96** that is secured to a shaft **97** journaled in a bracket **98** clamped on the lower end of the column **50**. The shaft **97** is adapted to be turned by a hand wheel, worm and worm wheel which are not shown but which are similar to the hand wheel **52**, worm **56** and worm wheel **58** hereinabove mentioned.

Inasmuch as the post **88** is supported from the column **50** through the rack teeth **95**, pinion **96** and shaft **97**, manipulation of the hand wheel **52** effects vertical ad-

justment of both the column **50** and the post **88**. Hence, the filling spouts **75** can be adjusted to accommodate cartons of different heights without disturbing the setting of the cups **80** to measure a given quantity of material. Similarly, the cups **80** can be adjusted to measure a different quantity of material, by turning the shaft **97** by means of its associated hand wheel (not shown), without disturbing the setting of the lower head **70** and of the filling spouts

Each measuring cup **80** is provided with a cutoff plate or gate **100** (Figs. 2, 3, 6, 7 and 8) that is mounted for movement to and from a position wherein the gate **100** retains a charge of material within the cup. The gate **100** comprises a flat plate secured at one end **101** (Figs. 2, 4 and 5) to a vertical pin **102** extending through and journaled in the head **70** and a boss **103** (Fig. 2) formed on the underside of the same. An arm **104** secured to the lower end of the pin **102** extends radially outward therefrom to a position outward of the peripheral edge of the head **70**. A no-carton, no-fill mechanism **105** (Fig. 2) is mounted on the frame **32** in position for a tripping pin **106** thereof to be engaged successively by the arms **104** as they are carried therepast by the rotating table **18**. The no-carton, no-fill mechanism **105** may be of conventional design, and since its structure and operation constitute no portion of the present invention, the present disclosure requires no detailed description of the mechanism other than the explanation that the tripping pin **106** is raised into operative position in response to the outward movement of a lever **107** (Figs. 2, 4 and 5). This lever **107** is mounted in position to be engaged and moved outward by each carton C in a pocket **21**, a brief interval after the carton has entered the filling machine **10**. In the event of interruption in the supply of cartons to the conveyor **14**, resulting in the passage of an empty pocket **21** past the lever **107**, the mechanism **105** will remain idle, the tripping pin will remain in a lowered position wherein the arms will clear the same, and the gates associated with the arms thus permitted to pass freely over the tripping pin will remain closed.

A supply hopper **110** is mounted on the upper head **84** which, as hereinabove explained, is prevented from rotating by being affixed to the non-rotatable post **88**. The hopper **110** is located at such a radial distance from the axis of the central post **88** that its open lower end overlies the annular plate **82**, as clearly shown in Fig. 3. Since an opening **112** is provided in the annular plate **82** for each measuring cup **80**, rotation of the head **70** about the vertical axis of the column **50** causes the measuring cups **80** to successively present their open upper ends to the open bottom of the hopper **110**. In this manner, each measuring cup is filled with material gravitating from the hopper **110**, once during each full turn of the rotary table **18** and lower head **70**.

The drive for the table **18** comprises an internally toothed ring gear **114** (Figs. 3 and 10) secured coaxially to the underside of the table **18** by a plurality of bolts **116**. A vertical stub shaft **118** is journaled in a boss **120** within the frame **32**, and a pinion gear **122** affixed to the upper end of the stub shaft **118** makes meshing engagement with the teeth of the ring gear **114**. The lower end of the stub shaft **118** carries a bevel gear **124** that is enmeshed with a bevel gear **126** carried by a drive shaft **128** journaled in and extending through a side of the frame **32**. A pulley **130** (Figs. 2 and 10) affixed to the outboard end of the drive shaft **128** adapts the mechanism to be driven from any suitable power source (not shown).

The construction and manner of operation of the filling spouts **75** can best be understood by references to Figs. 2 and 4 to 9, inclusive. Each filling spout **75** includes a shell **140** of generally U-shaped horizontal section, removably secured in fixed position to a boss **142** on the under surface of the lower head **70**. Whereas the two lateral sides **144** of the shell **140** are flat and parallel to each other, the back **146** of the shell **140** is arcuate in horizontal section, the outer surface of the back **146** being convex. The lateral sides **144** are disposed in vertical planes extending substantially radially of the head **70**. The back **146** inclines so as to dispose its lower end at a greater radial distance from the axis of rotation of the head **70** than its upper end. The shell **140** is secured to the head **70** by cap screws **148** extending through angle brackets **150** that are welded to the shell.

Two of the brackets **150** disposed at opposite sides of the shell **140** provide bearing support for a pivot rod **152** upon which a gate **154** is secured by a clamp **156**, the gate being disposed between the sides **144** of the shell **140** and substantially corresponding in width to the space between the sides **144**. The gate is arcuate in horizontal section, its outer face likewise being convex. The horizontal curvature of the shell's back **146** and that of the gate **154** are oppositely arranged, since the convex outer face of the back **146** faces inwardly of the head **70** while the convex outer face of the gate **154** faces outward, as best revealed in Fig. 9.

A coil spring **160** is under compression between the under surface of the head **70** and a finger **162** integral with the clamp **156** and extending from the pivotal mounting **152** of the same in an outward radial direction with respect to the head **70**. The spring **160** constantly urges the gate **154** to rotate toward the shell **140**, to an inward and downward inclined position (Fig. 6) wherein the lower end of the gate **154** is disposed so close to the lower end of the back **146** of the shell that the spacing between their most widely separated portions is substantially less than the distance between the sides **22** and **30** of a carton C. Therefore, when the gate and shell are thus disposed in a downwardly convergent relation, their lower ends are adapted for entry into the open upper end of a carton C. The lower, outer corners of the sides **144** of the shell **140** are notched as indicated at **164** to accommodate the outermost of the flaps **166** extending upward from the carton (see Fig. 7). A second finger **170** integral with and extending outward from the clamp **156** carries at its outer end a downwardly extending pin **172** upon which a cam follower roller **174** is rotatably mounted.

A cam rod **176** (Figs. 2, 3, 8 and 9) is supported by the posts **38** (Fig. 2) in a horizontal plane and extending in an arc whose center lies in the axis of rotation of the table **18**. The cam rod **176** extends in the circular path of the cam follower rollers **174**, so that as the table **18** turns, the rollers successively engage an end **178** of the cam rod, which is so disposed that each roller **174** engages the end **178** of the cam rod **176** a brief interval before the gate-opening arm **104** of the associated measuring cup **80** arrives in position of engagement with the tripping pin **106**. The end **178** of the rod **176** is so beveled that as a roller **174** advances along its inclined surface, the roller is cammed radially outwardly, against the urgency of the associated spring **160**. This moves the associated gate **154** from the position illustrated in Figs. 6 and 7 to that of Figs. 8 and 9, wherein the center of the lower end of the gate **154** and the center of the lower end of the back **146** of the shell **140** are spaced apart by a distance considerably greater than the normal distance between the walls **22** and **30** of a carton C, i.e., the spacing of the walls **22** and **30** when the carton C is in its normal, rectangular configuration.

When thus moved to its position of maximum spacing from the back **146**, the lateral edges of the gate **154** remain between the sides or wings **144** of the shell **140**, so that while in this position the shell **140** and the gate **154** function efficiently to funnel material from the associated measuring cup **80** into a carton C arranged in receiving position below the spout **75**.

The belt **16** of the conveyor **14** is so positioned on the rotary table **18** that as any one of the conveyor pockets

21 approaches the point of tangency of the belt with the table, one of the filling spouts 75 moves into register with the pocket. The horizontal plate 26 of the conveyor 14 is mounted at an elevation spaced below the lowermost portions of the spouts 75 by a distance slightly in excess of the total height of a carton C whose lower end is closed and whose closing flaps 166 at the upper end of the carton extend vertically upward from the carton walls. This permits the cartons C, with their upper ends open, to pass freely into the filling machine and into position below the filling spouts 75 (Fig. 2).

Immediately after reaching the said point of tangency, the cartons C successively pass off the terminal end of the plate 26, and onto a lifting cam 180 (Figs. 1, 2, 4, 5, 6 and 10) that is rigidly secured to a shaft 182 journaled in the frame 32 above and parallel to the drive shaft (see Figs. 2 and 10). The cam 180 has a high lobe 184 (Fig. 10) whose peripheral extent is approximately 120°, and the cam shaft 182 is so positioned that when the lobe 184 is down, all parts of the cam 180 are below the plane of the horizontal plate 26 of the conveyor 14. Thus, a carton C in sliding off the end of the plate 26 is enabled to pass freely into a position above the cam 180. The cam 180 is adapted to be rotated so that while a carton C is positioned above the cam, the high lobe 184 engages the bottom 24 of the carton and lifts the carton to an elevated position wherein the open upper end of the carton embraces the lower ends of the back 146 and gate 154 of the filling spout 75 then disposed above the carton. The mechanism for rotating the cam 180 in timed relation with the rotary table 18 and the conveyor belt 16 is illustrated diagrammatically in Fig. 10, and includes a sprocket gear 186 on the drive shaft 128. The gear 186 is connected by an endless chain 188 to a driven sprocket gear 190 on the cam shaft 182.

An auxiliary guide rod 185 (Figs. 2 and 4 to 7) is supported by the bracket 31 and upper rod supporting strip 35. This rod 185 assists in guiding the cartons C as they enter the filling machine, into such position below the spouts 75 that when the cartons are lifted by the cam 180, they will be properly aligned with the lower ends of the filling spouts.

The cam 180 operates to lift each carton in the manner described, without interrupting the forward progress of the carton, so that after the carton is raised into engagement with a filling spout 75, the carton is pushed forward onto and along a slide 192, while remaining in proper position with relation to the spout to receive material therefrom. The slide 192 (Figs. 2 to 5) preferably is in the form of a plurality of closely spaced parallel rods 194 in horizontal transverse alignment. The initial portion of the slide 192 extends horizontally and therefore continues to support the advancing carton in its elevated, or filling position. The cam rod 176 is of ample length to assure that the entire contents of a measuring cup 80 is discharged into the carton before the associated cam follower roller 174 reaches the terminal end 196 (Fig. 1) of the cam rod; and after passing the terminal end 196, where the spring 160 is permitted to return the gate 154 of the spout to its retracted position, the filled carton passes onto a downwardly inclined portion 198 of the slide 192. Consequently, before a carton completes 180° of travel in the filling machine 10 and passes therefrom onto the discharge portion 200 of the conveyor 14, the filled carton C is lowered sufficiently to clear the filling spout 75 from which it has received a charge of material.

A pressure plate 210 (Fig. 1) is rigidly mounted in position to be slidably engaged by the outer wall 30 of each carton C after the carton leaves the filling machine 10 and as the carton is slid along the discharge portion 200 of the conveyor. The terminal end 212 of the plate 210 is disposed in a vertical plane, and is spaced from the belt 16 by a distance approximately equal to the thickness of a carton C when the latter is in its normal, rectangular form. The other end 214 of the plate, i.e., the end first reached by the advancing cartons, inclines upward and outward slightly, and is spaced from the belt 16 by a distance somewhat greater than the normal thickness of a carton C.

The carton closing machine 12 is illustrated diagrammatically in Fig. 1. The present invention is not concerned with the details of structure, nor with the manner of operation, of the closing machine 12, and it will suffice, therefore, for the purpose of the present disclosure, to explain that the closing machine 12 is so disposed in relation to the discharge portion 200 of the conveyor 14 that each carton, after leaving the pressure plate 210, enters the closing machine 12, which engages the several closure flaps 166 extending vertically upward from the sides of the carton, and folds the flaps inward and down, thus effectually closing the filled carton. A suitable bonding agent may be applied to one or more of the flaps before they are closed, either within the closing machine 12 or otherwise, depending upon the nature of the material being packaged, the type of carton being employed, and other circumstances.

Operation

It will be assumed that power is applied to the pulley 130 (Figs. 2 and 10) causing rotation of the table 18 and actuation of the conveyor belt 16. Before cartons are supplied to the machine, bulk material to be packaged is placed within the hopper 110, and during operation of the apparatus the hopper is replenished with sufficient frequency to maintain an ample supply within the hopper at all times. Empty cartons C to be filled are placed individually in the pockets 21 of the conveyor 14 as the pockets 21 are approaching the filling machine 10. Each carton C is closed at its bottom end and open at its top end with the closure end flaps 166 at the top of the carton extending vertically upward from the sides of the carton, as indicated at C1 in Figs. 1 and 6.

So that the method of the present invention and the manner of operation of the apparatus may most readily be understood, the progress of a single carton through the apparatus will be described, with the understanding, however, that the cartons are supplied to and advanced through the apparatus in continuous procession and at a high rate of speed.

The parts of the apparatus are so synchronized that as a carton C passes off the horizontal plate 26 (Figs. 1 and 2) and enters the filling machine 10, the lobe 184 of the carton lifting cam 180 is disposed in a downward position so that the carton can pass freely into position over the cam. While the carton is thus disposed, the cam 180 turns its lobe 184 upward, causing the same to engage the bottom of the carton and lift it to an elevation equal to or slightly higher than the receiving end of the slide 192, so that as the carton continues to advance it is maintained in an elevated position for an appreciable period.

As the carton is lifted by the cam 180 to the position C2 (Figs. 1 and 7) its open upper end, as defined by the upstanding flaps, is raised into position surrounding the collapsed lower end of a filling spout 75. Immediately thereafter, the cam follower roller 174 of the spout 75 engages the end 178 of the cam rod 176 (Fig. 2) whose outwardly inclined surface cams the roller 174 outward as the roller is advanced along the same in conformity with rotation of the table 18. The gate 154 of the associated spout 75 is thus caused to swing outward from the position thereof illustrated in Figs. 6 and 7 to that of Fig. 8. Since the material of the carton is relatively stiff, in spite of the fact that the hinge lines defining the juncture of the flaps 166 with the side walls may have been scored, and since the back 146 and gate 154 of the filling spout 75 make point contact with portions of the flaps intermediate the lateral sides of the same, the outward pressure exerted against the flaps by the back 146 and gate 154, causes the inner and outer sides 22 and 30

of the carton to bow outward, as indicated at C3 (Figs. 1 and 8). In this manner the open top of the carton is distended from its normal rectangular form to that of an oval having relatively narrow flat ends, as clearly shown at C3 and C4 in Fig. 1. The greater thickness of the upper portion of the carton thus attained, is accommodated by the greater distance of the upper guide rod 33 from the belt 16 than that of the lower guide rod 34 (see Fig. 8). Therefore, before the associated gate-operating arm 104 engages the tripping pin 106 of the no-carton, no-fill mechanism 105 (Fig. 2) the effective area of the open end of the carton is substantially increased even though the length of a line defining the perimeter of the opening remains unchanged.

For example, if the dimensions of the end of the carton are 4 inches by 1¼ inches when in its normal, rectangular form, the area of the open end is 5 square inches. If the long sides of the rectangle are bowed outward until their mid points are spaced 2¼ inches apart, the length of the opening is reduced only about one quarter of an inch, and the area of the deformed opening is 6 15/16 square inches, an increase of more than 25%.

It is readily apparent that the increase in area of the opening at the top of the carton, permits introduction of a given quantity of material into the carton at a considerably increased flow rate, without any increased tendency for the material to choke the throat of the filling spout by bridging therein. Therefore, the filling machine can be operated at an increased rate, even though this causes the arm 104 to swing more rapidly when it encounters the tripping pin 106, and withdraws the gate 100 from under the associated measuring cup more quickly. The correspondingly increased rate at which the measured charge of material is released from the measuring cup does not jeopardize efficient delivery of the material to the cartons, and yet the increased filling rate permits the entire system of which the filling machine 10 is a part, to be operated so much faster that the hourly capacity of the system is substantially increased.

The parts of the apparatus are so proportioned that the entire measured charge of material is released from the measuring cup 80 well before the cam follower roller 174 passes off the terminal end 196 of the cam rod 176 (Fig. 1), at which time the spring 160 is permitted to return the gate 154 of the filling spout 75 to its position closer to the back 146, as in Fig. 6. This relieves the pressure of the filling spout against the walls of the carton, but the latter tend to remain in their outwardly bowed condition, due to the pressure exerted thereagainst by the carton's contents, as indicated at C4 (Fig. 1).

Upon passing beyond the cam rod 176 the carton is slid along the downwardly inclined portion 198 (Fig. 1) of the slide 192, thus lowering the carton until its upper extremities are at a lower elevation than the lower end of the filling spout. This permits the filled carton C to enter and travel along the straight, discharge portion 200 of the conveyor 14, while the filling spout 75 diverges therefrom in its circular orbit. The open gate 100 of the emptied measuring cup 80 then engages a closing device (not shown) which operates to return the gate 100 to its closing position, thereby placing the measuring cup in condition to be refilled as the initial step of its subsequent cycle of operation. Refilling occurs when the measuring cup, with its gate 100 closed, passes under the magazine 110, permitting a new charge of material to gravitate from the magazine into the measuring cup.

As the filled, open carton C enters the discharge portion 200 of the conveyor 14, its side walls are still in an outwardly bulged condition, due to the non-fluid nature of the carton's contents. The outward inclination of the end 214 of the pressure plate which is first encountered by the carton permits the bulged carton to pass the end 214 and thus enter the space between the plate 210 and the conveyor belt 16, as indicated at C5 (Fig. 1). As the carton C continues to advance, this space gradually becomes increasingly restricted, due to the convergence of the plate 210 with the belt 16 in the direction of carton advance, and due to the spiral form of the plate. Accordingly, the carton is gradually compressed as it advances past the plate 210, as indicated at C6 (Fig. 1). The terminal end 212 of the plate 210 is vertical, and is spaced from the belt 16 by a distance substantially corresponding to the normal thickness of the carton. Therefore, as the carton passes the terminal end 212, it is compressed back to its normal, rectangular configuration, as indicated at C7 (Fig. 1.)

It has been found that when the area of the upper, open end of the carton is increased by bowing two opposite sides thereof outward, as hereinabove described, the length, i.e., the height of the carton, is diminished by such a small amount as to be negligible, if at all. It is apparent that if the length of a carton remains constant while the cross sectional area of an end of the carton is increased, the volumetric capacity of the carton is correspondingly increased. The fact that the carton receives a charge of material from a measuring pocket 80 while the carton is distended by an expanded filling spout, permits adjustment of the measuring cups 80 so that each is adapted to segregate and deliver to a carton, a quantity of material slightly in excess of the normal capacity thereof, i.e., in excess of the capacity of the carton when the same is in its normal, rectangular condition. The expanded condition of the carton enables the carton to receive without spilling, a sufficient excess quantity of the material to compensate for the loosely compacted condition of the material resulting from the tumbling that it receives as it falls from the hopper 110 into the measuring cup 80 and as it falls from the measuring cup into the carton. The squeezing which the filled carton receives from the pressure plate 210, and the pressure applied to the contents of the carton as its closure flaps are closed by the carton closing machine 12 immediately after the carton leaves the pressure plate, have the effect of compacting the material to a volume coinciding with the normal capacity of the carton. As the material becomes thus compacted, its density is increased to an extent minimizing any further compacting of the same after the carton is closed. Therefore, even when subjected to the vibration and jouncing coincident to the further processing of the package after the same leaves the closing machine, such as that experienced by the carton during its passage through a wrapping machine, the volume of the carton's contents will not be further reduced to any appreciable extent.

Thus, it may be seen that when cartons are filled with loose, or bulk material in accordance with the method, and by means of the apparatus of the present invention, cartons of the end-fill type may be used which are of smaller dimensions than those heretofore necessarily employed to receive the same quantity of the same material, when filled otherwise than by the method hereinabove set forth. This reduces the cost of the cartons, as well as the size and cost of the cases in which wholesale quantities of the cartons are shipped. Furthermore, since the contents of a carton filled in accordance with the method of the present invention do not compact to a smaller volume after the carton is closed, the carton remains tightly filled, i.e., does not develop voids. The particles of the material therefore remain in tight pressure engagement with the walls of the carton, as well as with each other, thus causing the filled package as a whole to maintain a high coefficient to heat conductivity—an important factor in connection with the processing of certain commodities for freezing.

While a preferred apparatus and a preferred method for carrying out the invention have been shown and described, it will be understood that both are capable of

modification and variation while still employing the principles of the invention. It is to be understood, therefore, that the scope of the invention should be limited only by the scope and proper interpretation of the claims appended hereto.

The invention having been thus described, that which is believed to be new and for which protection by Letters Patent is desired, is:

1. In a packaging machine, apparatus for packing material in rectangular cartons comprising means for supporting a carton having one end thereof open, means engaging a side of the carton for bowing the side of the carton outward, means controlling said wall bowing means to temporarily increase the volumetric capacity of the carton, means for feeding into the distended carton a quantity of material in excess of the carton's normal capacity, means for closing the carton, and means for flattening said walls to compress said material and thereby cause the same to completely fill the closed carton.

2. In packaging machines, apparatus for packing material in rectangular cartons comprising means for supporting a carton in a position with an open end facing in a predetermined direction, a laterally expandable filling spout mounted adjacent said supporting means, means for entering the spout into said open end of the carton, means for expanding the spout to bow walls of the carton outward, means controlling said spout expanding means to temporarily increase the volumetric capacity of the carton, means for feeding material into the carton through the expanded spout, means for separating the carton and spout, and means for flattening said walls to decrease to normal the capacity of the carton.

3. In packaging machines, apparatus for packing material in rectangular cartons comprising means for supporting a carton in a position with an open end facing in a predetermined direction, a laterally expandable filling spout mounted adjacent said supporting means, means for entering the spout into said open end of the carton, means for expanding the spout to bow walls of the carton outward, means controlling said spout expanding means to temporarily increase the volumetric capacity of the carton, means for feeding material into the carton through the expanded spout, and means for separating said spout and carton to permit return of said walls to normal configuration.

4. In apparatus for preparing material for freezing, machinery for packaging the material in rectangular cartons comprising conveyor means for transporting along a predetermined path a carton having an upwardly directed open end, a horizontally expandable filling spout mounted for movement adjacent said predetermined path, means for aligning the spout and the carton in register with each other and for advancing the spout and carton along congruent paths, means for expanding the spout to temporarily flex walls of the carton outward and thereby increase the area of said open end and to correspondingly increase the volumetric capacity of the carton, means for feeding material to be frozen through the spout into the carton, and means for separating the spout and carton to permit return of said walls to their normal configuration.

5. In apparatus for preparing material for freezing, machinery for packaging the material in rectangular cartons comprising conveyor means for transporting along a predetermined path a carton having an upwardly directed open end, a horizontally expandable filling spout mounted for movement adjacent said predetermined path, means for aligning the spout and the carton in register with each other and for advancing the spout and carton along congruent paths, means for temporarily expanding the spout and to flex walls of the carton outward and thereby increase the area of said open end and to correspondingly increase the volumetric capacity of the carton, means for feeding material to be frozen through the spout into the carton, means for separating the spout and carton, and means for flattening said walls to decrease to normal the capacity of the carton.

6. In apparatus for preparing material for freezing, machinery for packaging the material in rectangular cartons comprising conveyor means for transporting along a predetermined path a carton having an upwardly directed open end, a horizontally expandable filling spout mounted for movement adjacent said predetermined path, means for aligning the spout and the carton in register with each other and for advancing the spout and carton along congruent paths, means for expanding the spout and to flex walls of the carton outward and thereby increase the area of said open end and to correspondingly increase the volumetric capacity of the carton, means for feeding material to be frozen through the spout into the carton, means for separating the spout and carton, means for closing the carton, and means for flattening said walls to decrease to normal the capacity of the carton and thereby to compact the material snugly within the carton.

7. Apparatus for filling a carton including a body portion having an open upper end, comprising means for supplying material with which a carton is to be filled, and a spout adapted to guide the material from the supplying means into the carton and including opposed cooperating guiding members extending downward from said supplying means, one of said guiding members being pivotally mounted for movement toward and away from the other guiding member, means for yieldably moving said pivotally movable guiding member toward the other guiding member to a position wherein the lower ends of the members are adapted for entry into the open upper end of the carton, and means for moving said pivotally movable member away from the other member while the lower ends of the members extend into the open upper end of the carton, said members including means for bowing walls of the body of the carton outward upon movement of said movable member away from the other member to increase the area of the open upper end of the carton.

References Cited in the file of this patent

UNITED STATES PATENTS

803,357	Peile	Oct. 31, 1905
2,481,611	Moore	Sept. 13, 1949
2,496,609	Van Antwerpen	Feb. 7, 1950
2,676,442	Gaubert	Apr. 27, 1954