United States Patent [19]

Rossi

[11] **3,805,484**

[45] **Apr. 23, 1974**

[54] **HIGH SPEED AUTOMATIC CASING MACHINE**

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[22] Filed: **Sept. 24, 1971**

[21] Appl. No.: **183,477**

[52] **U.S. Cl.** **53/159,** 53/242, 53/251

[51] **Int. Cl.** **B65b 5/06,** B65b 35/44

[58] **Field of Search** ..... 53/159, 166, 242, 243, 53/251, 3.81 R, 392

[56] **References Cited**

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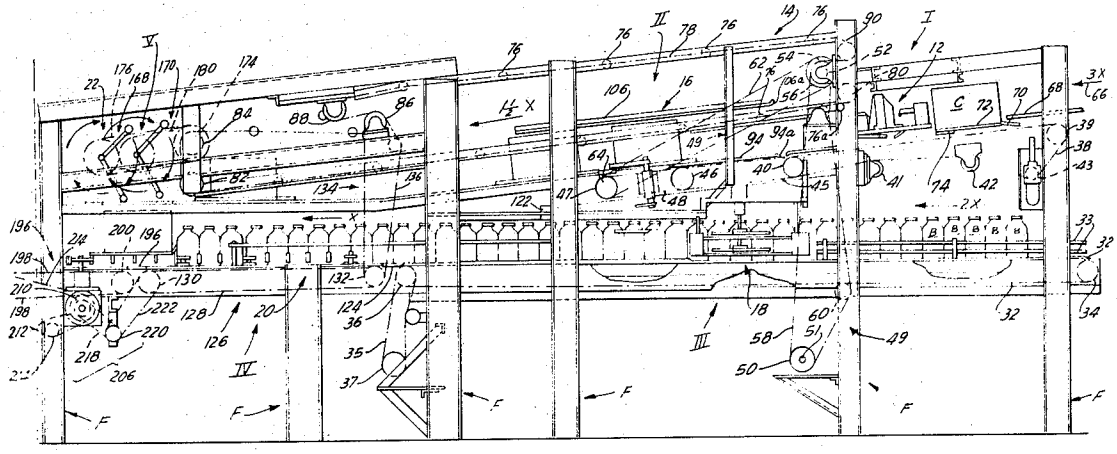
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Primary Examiner—Robert L. Spruill

[57] **ABSTRACT**

An automatic case packing apparatus is disclosed in which a plurality of separate operations are performed on incoming cartons and articles, thereby to pack the articles in the cartons and close and seal same. The cartons are received with top flaps closed and sealed and at least the bottom side flaps open. Means are provided for opening the bottom front and rear flaps if they are closed, and conveying the carton with all bottom flaps open to a packing station. The articles are received at the inlet in a single row, divided into a double row and conveyed to an indexing mechanism which is effective to separate the articles into distinct groups sufficient to fill the cartons. The thus grouped articles are conveyed to the packing station under an empty carton and means are provided for lowering a carton onto a group of articles in timed sequence with the carton and article conveying means. The cartons are then moved in the same direction by another conveyor means to mechanisms which are effective sequentially to close the front and rear flaps and thence past a gluing and side flap closing station where means are provided for applying glue to the side flaps and closing same, whereby the carton is rendered ready for shipment.

32 Claims, 32 Drawing Figures



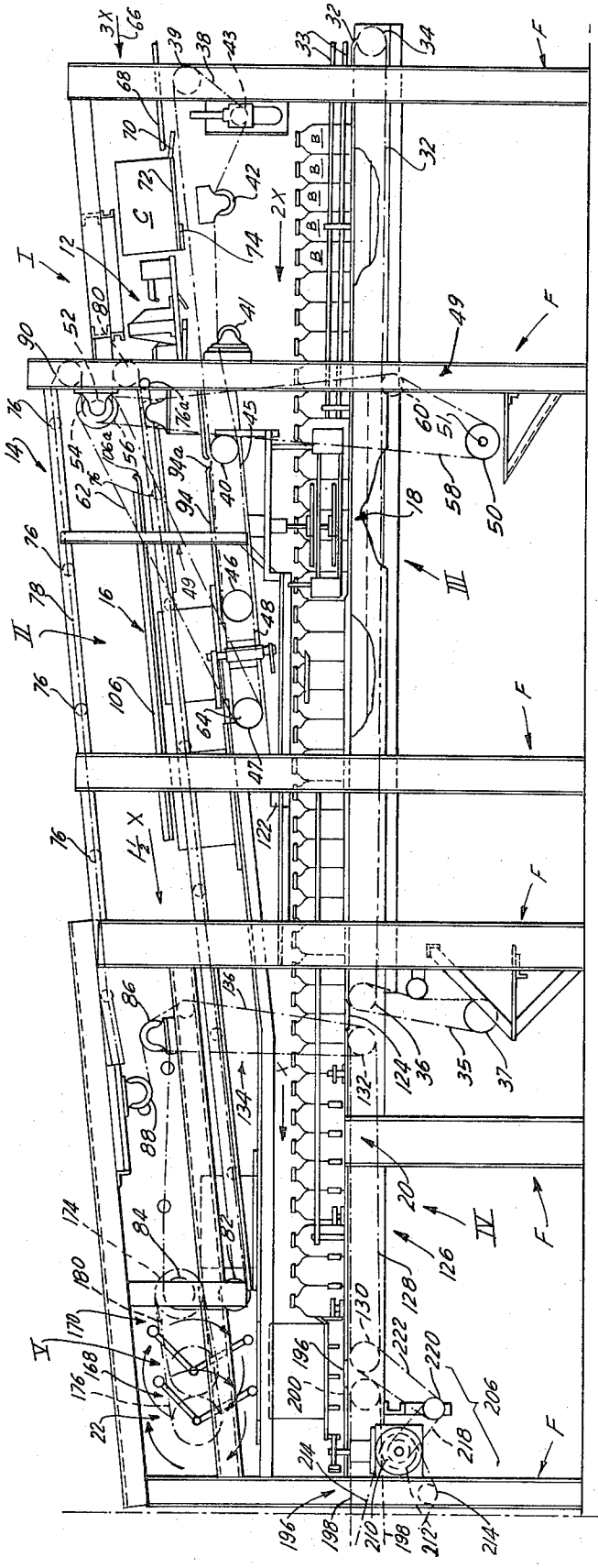


FIG. 1A

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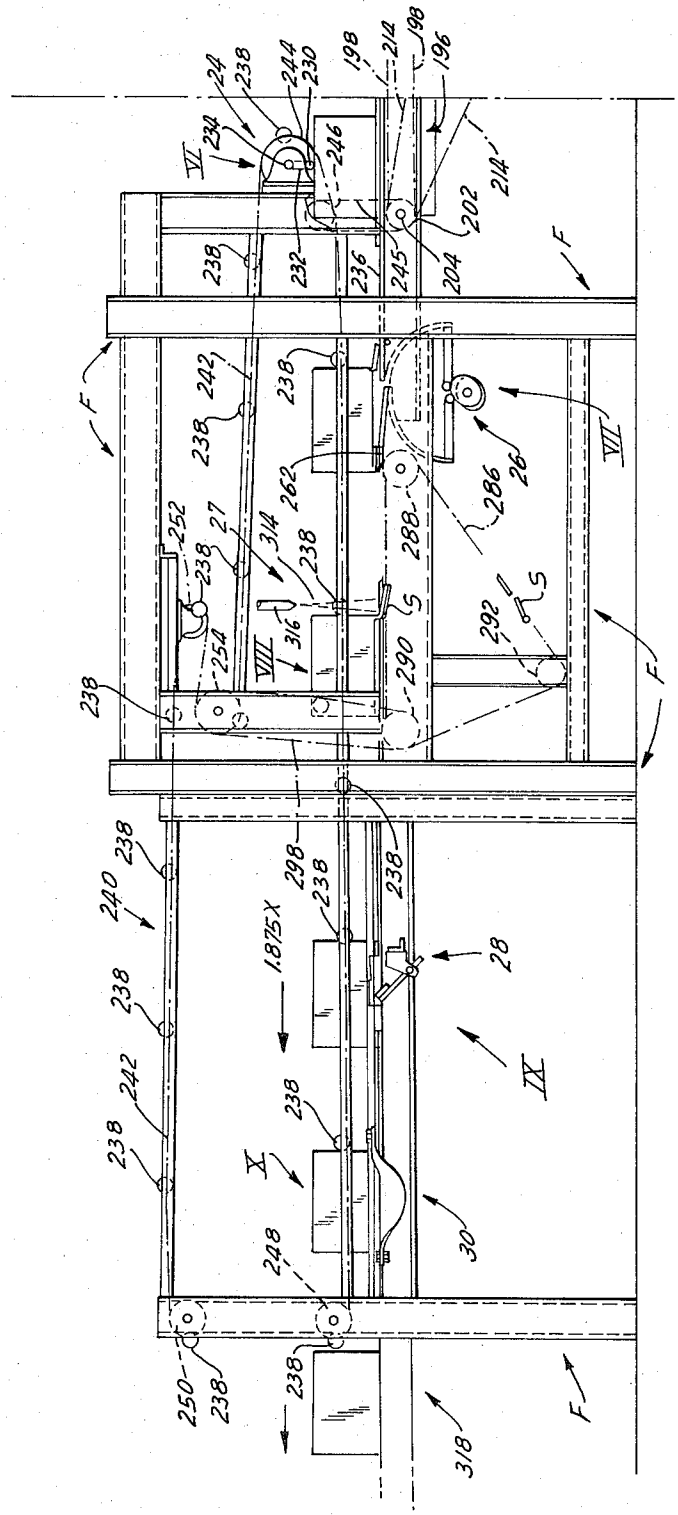


FIG. 1B

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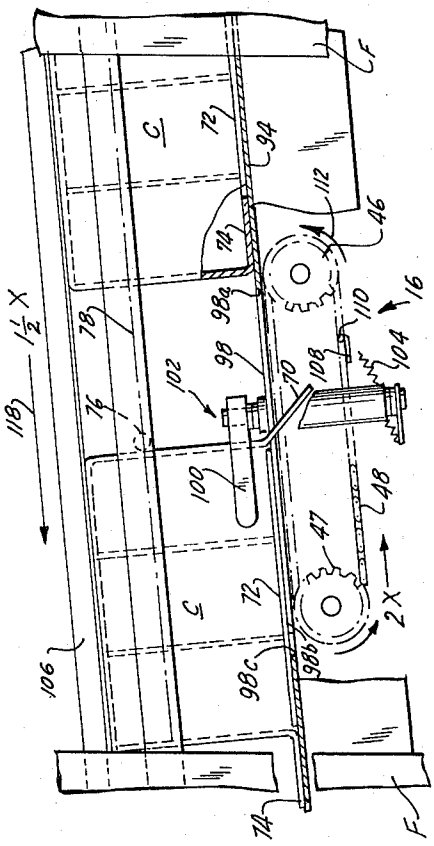


FIG. 2A

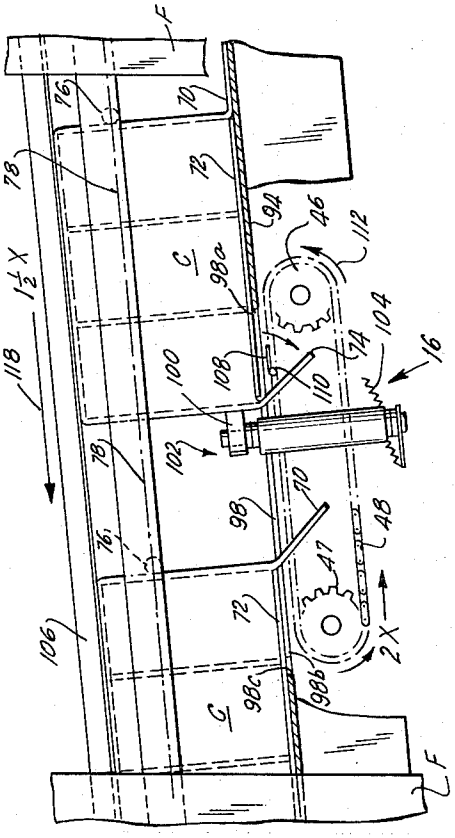


FIG. 2B

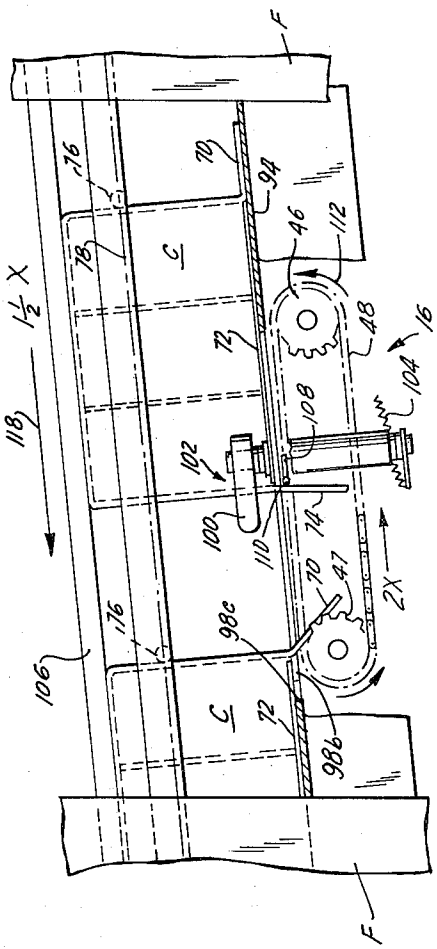


FIG. 2C

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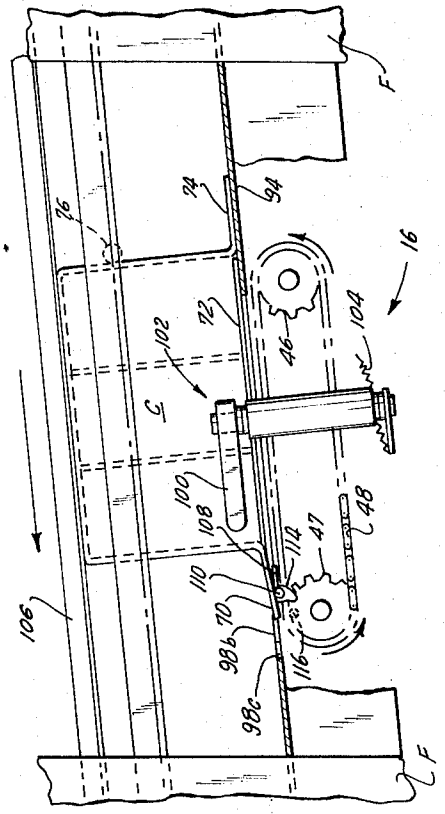


FIG. 2D

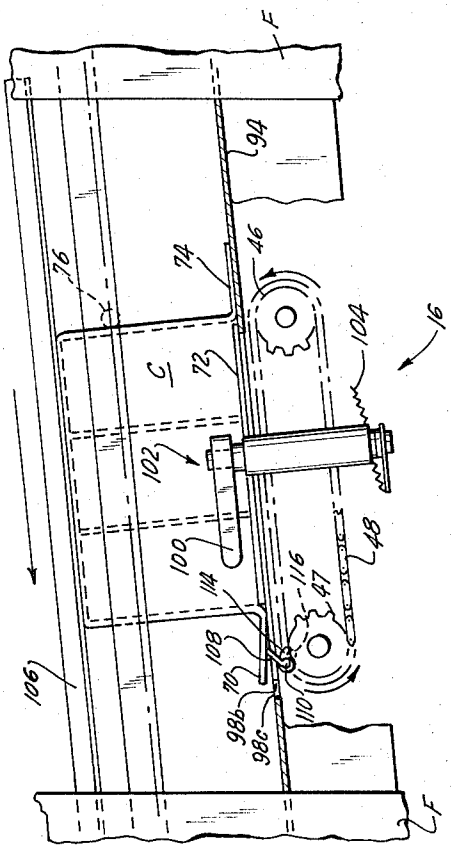


FIG. 2E

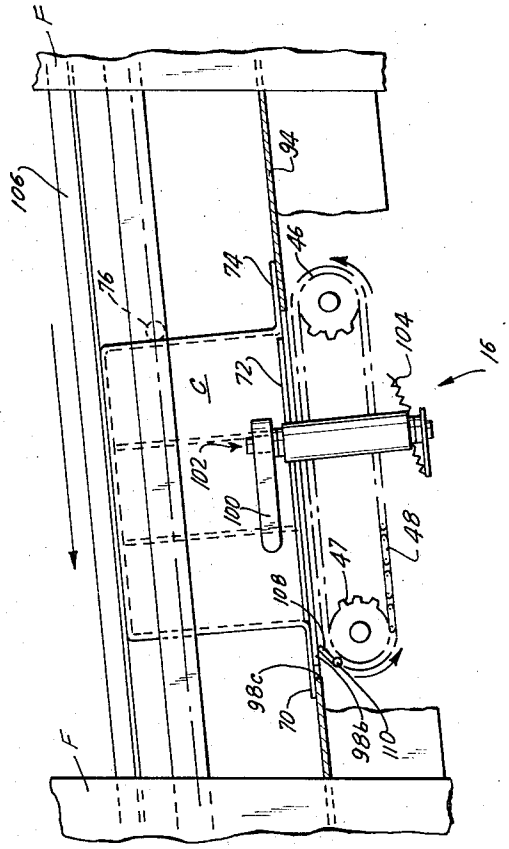


FIG. 2F

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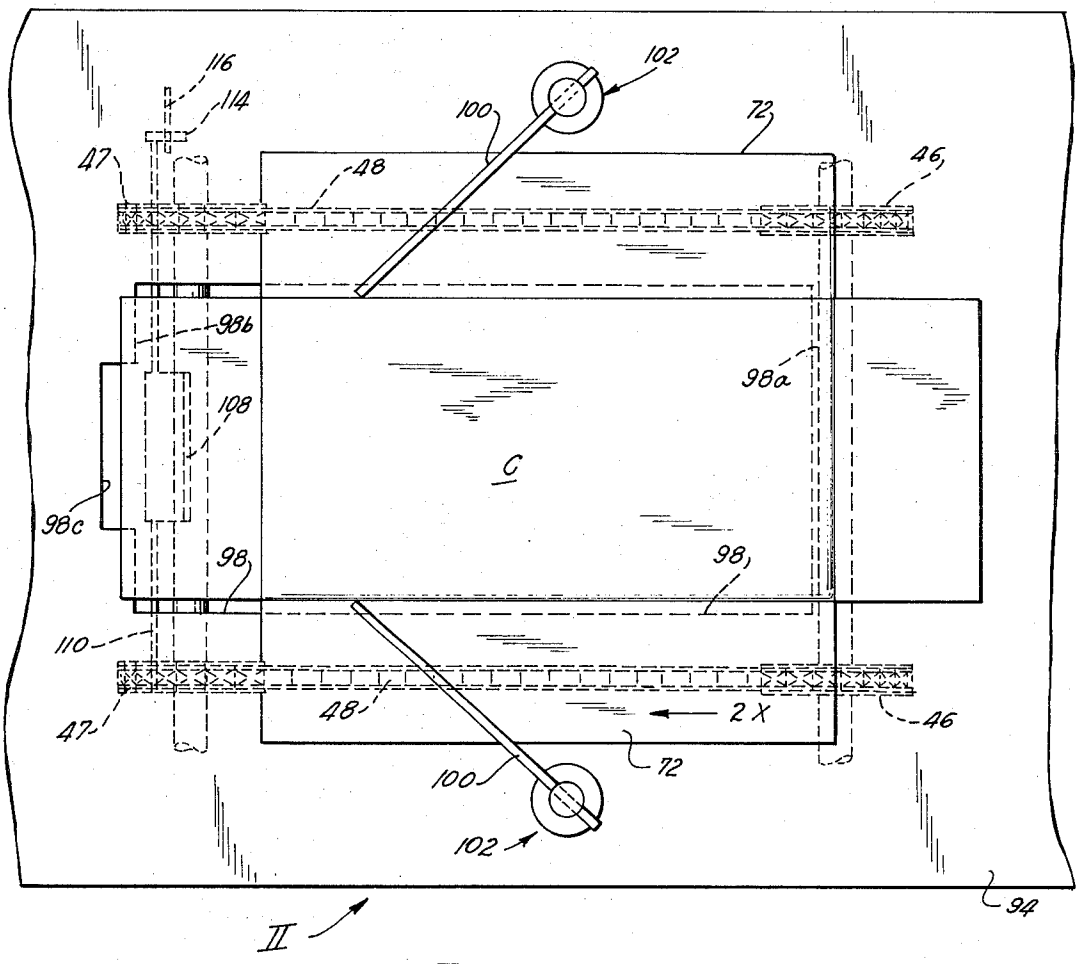
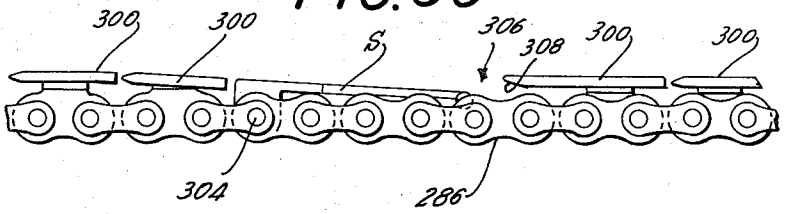


FIG. 2G

FIG. 8G



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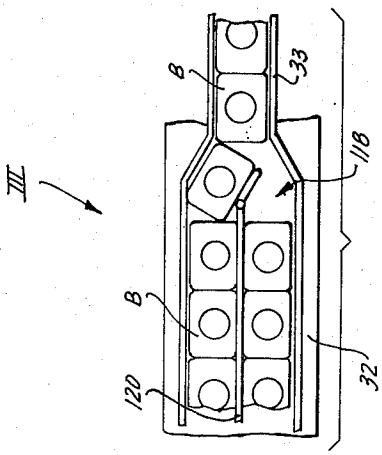


FIG. 3

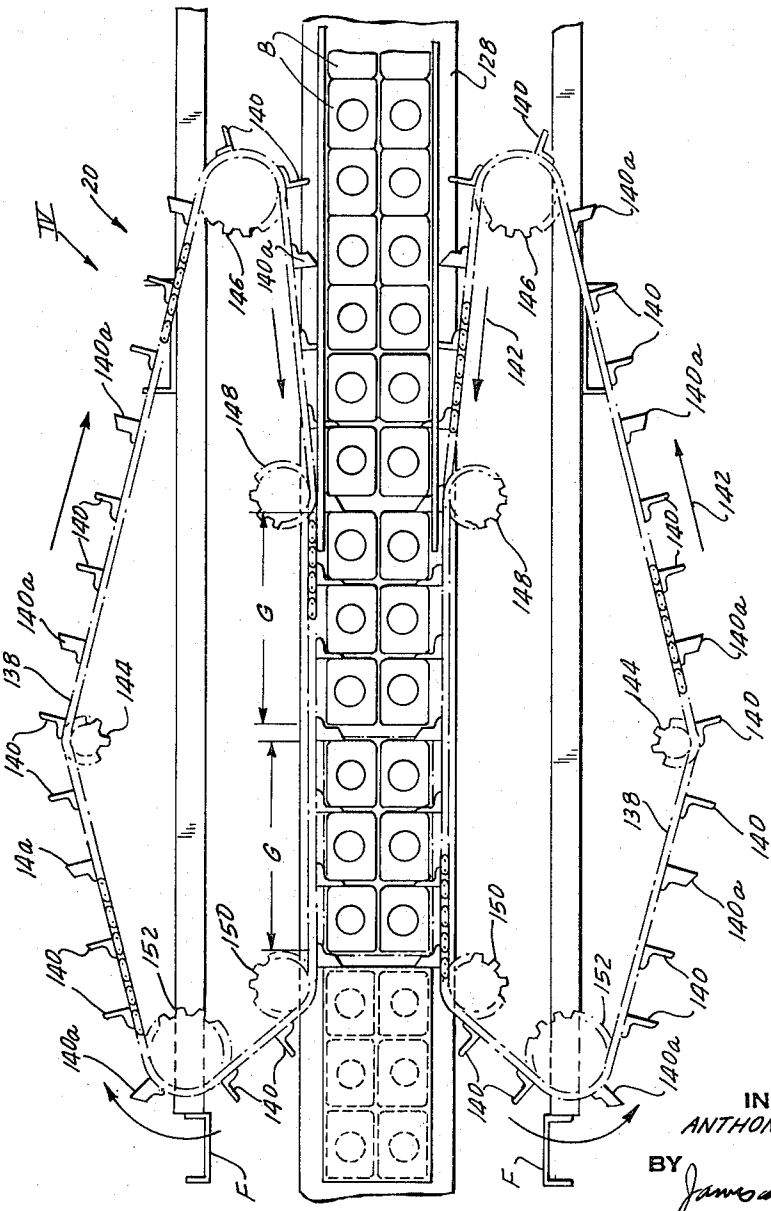


FIG. 4

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FIG. 5A

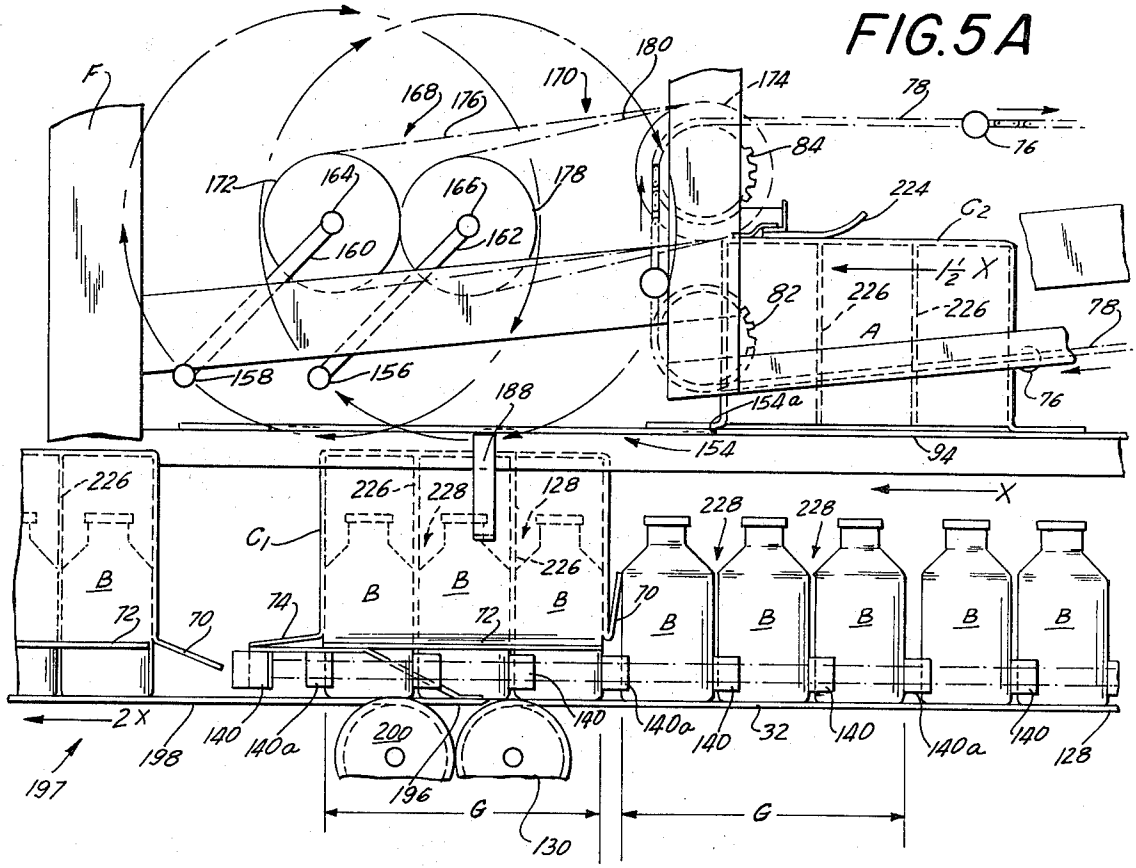
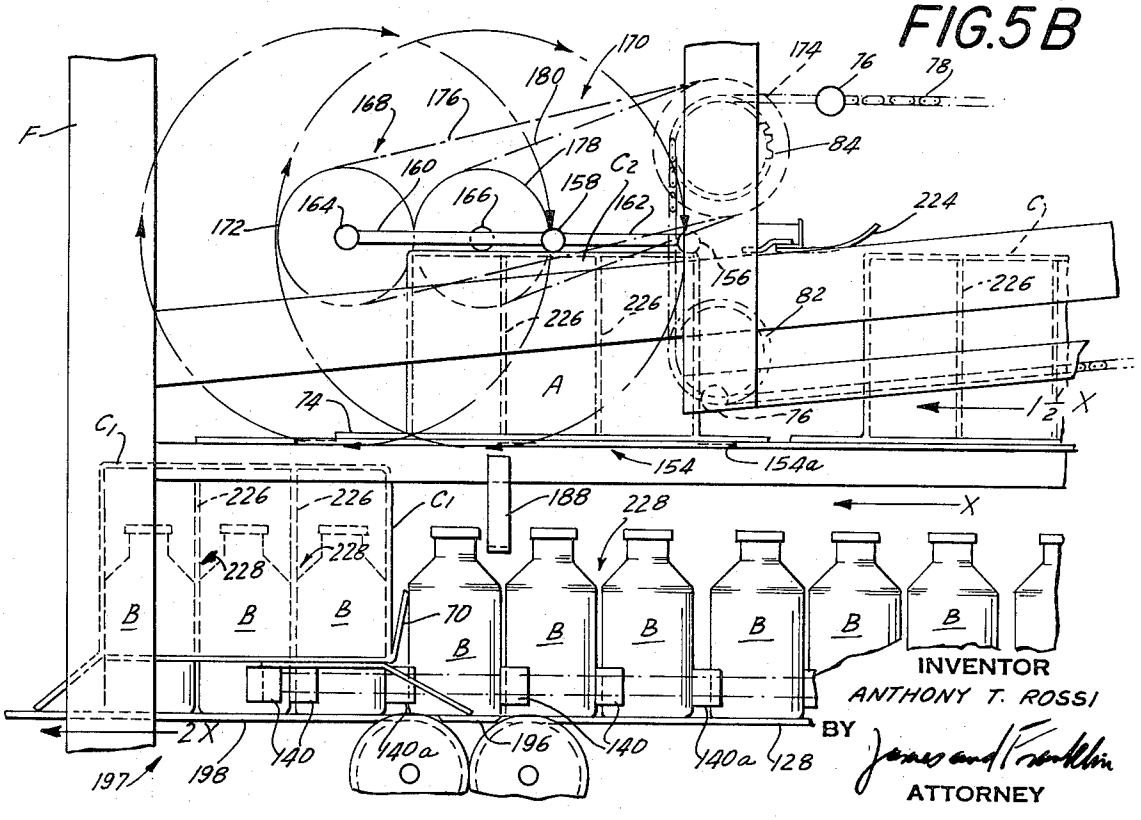


FIG. 5B



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FIG.5C

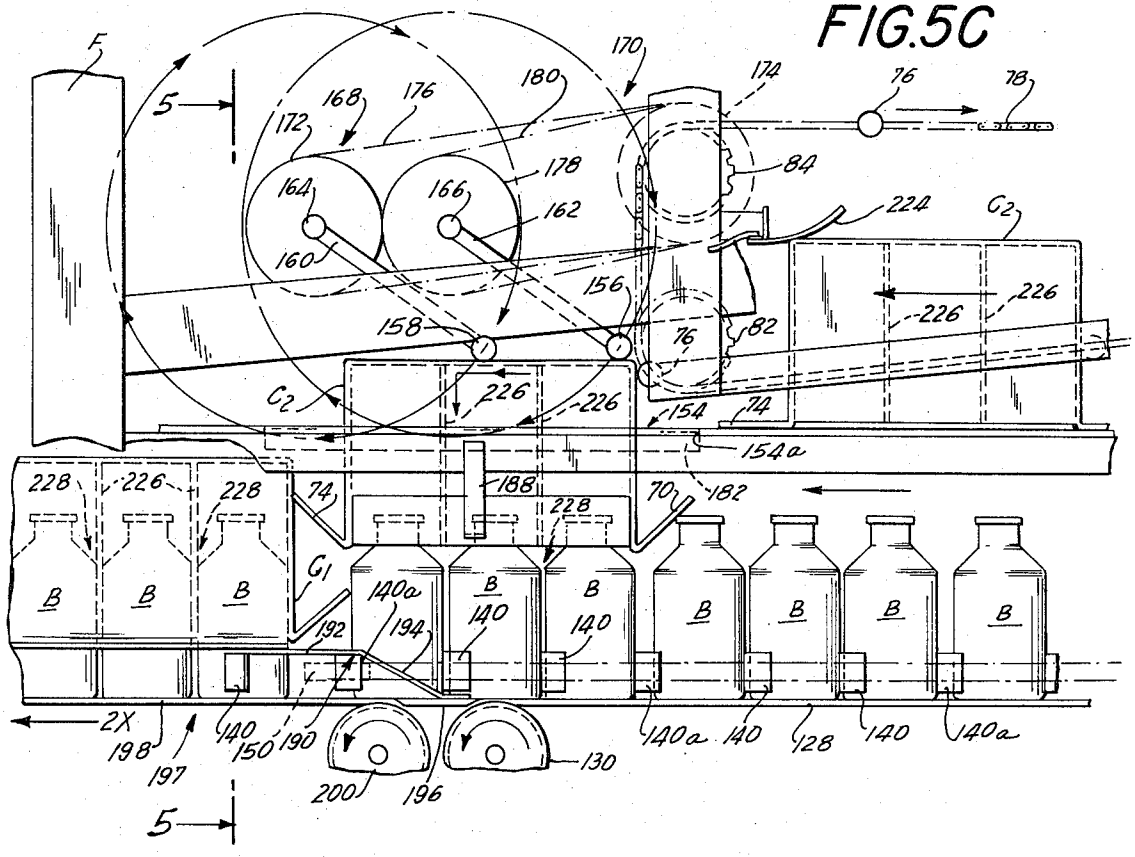
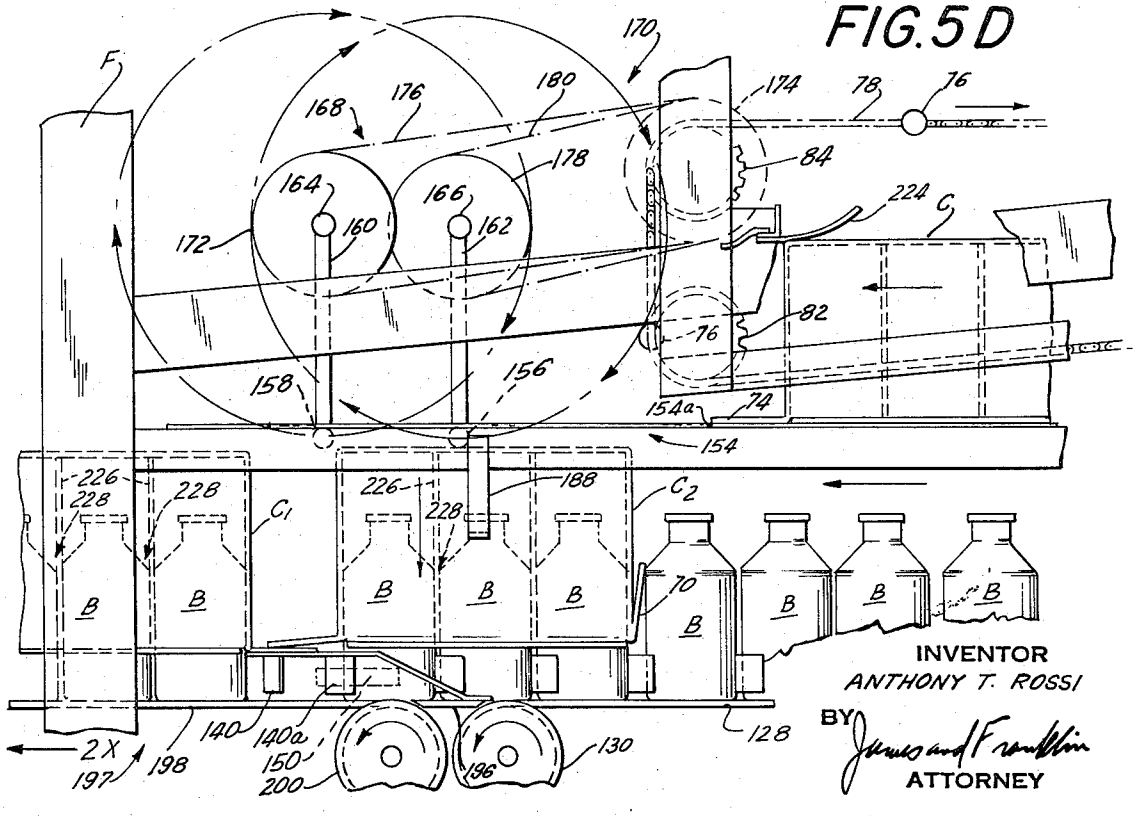


FIG.5D



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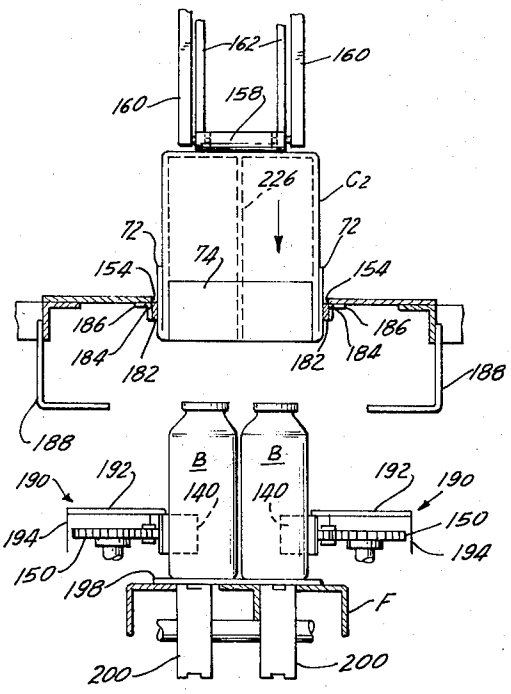


FIG. 5F

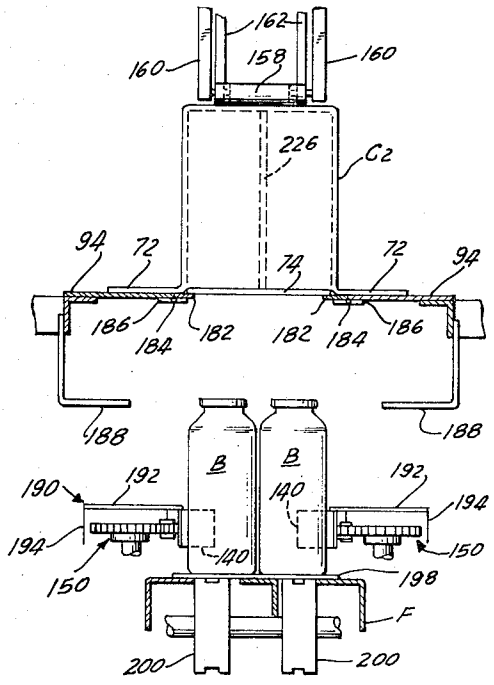


FIG. 5E

FIG. 5H

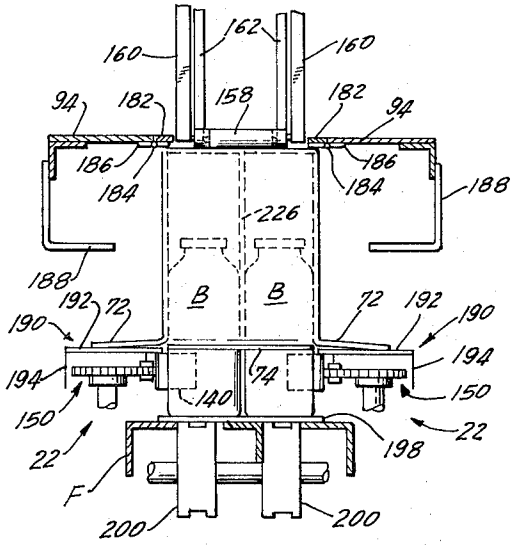
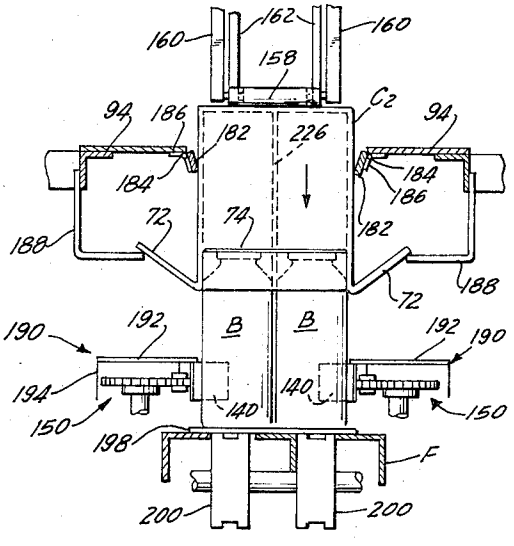


FIG. 5G



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FIG. 6A

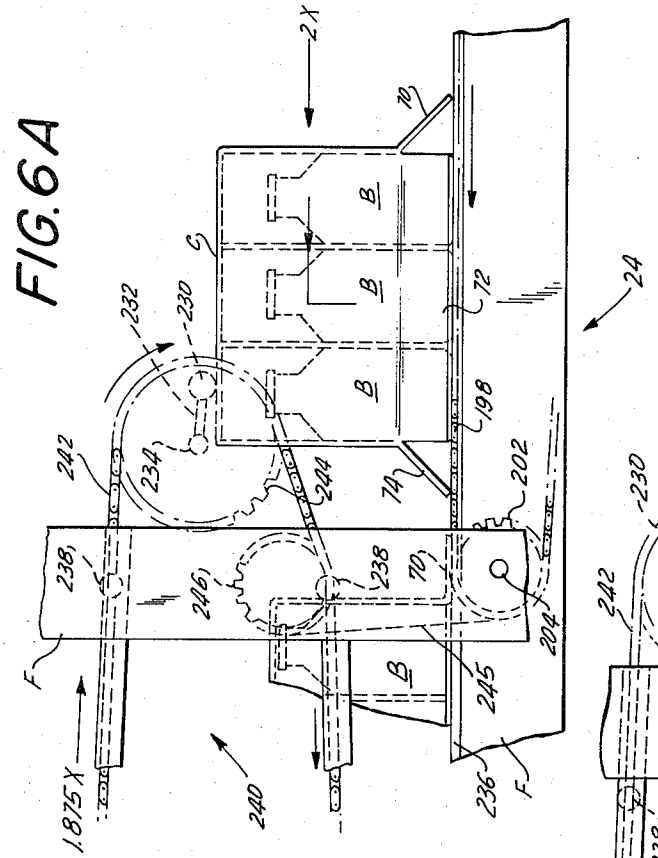


FIG. 6B

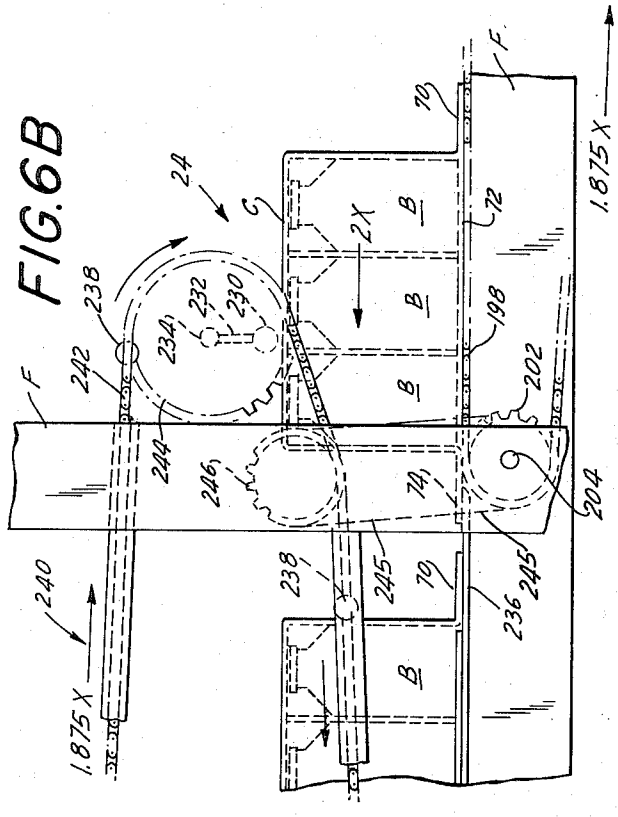
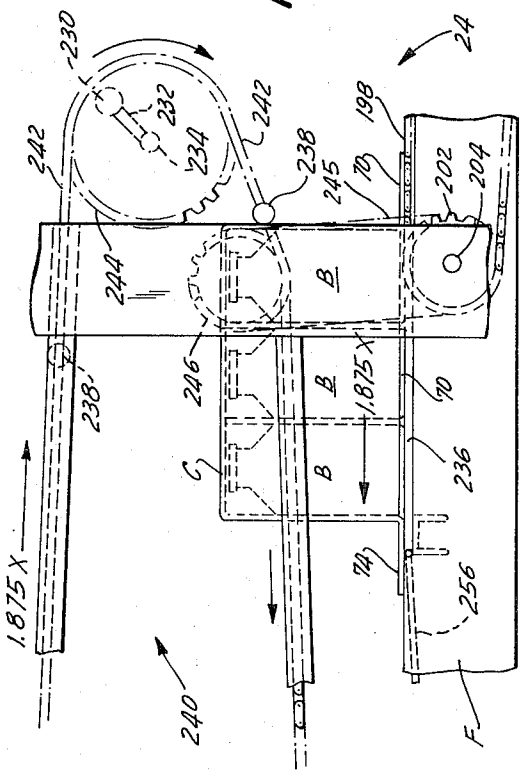


FIG. 6C



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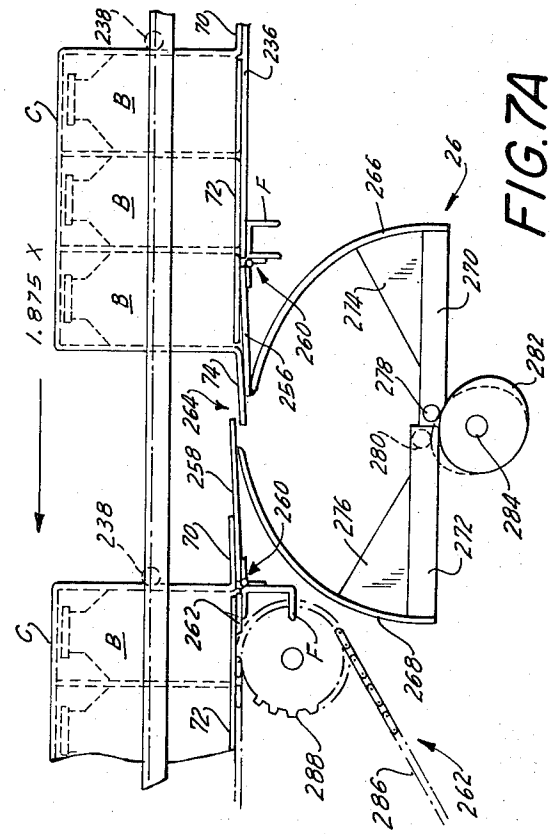


FIG.7A

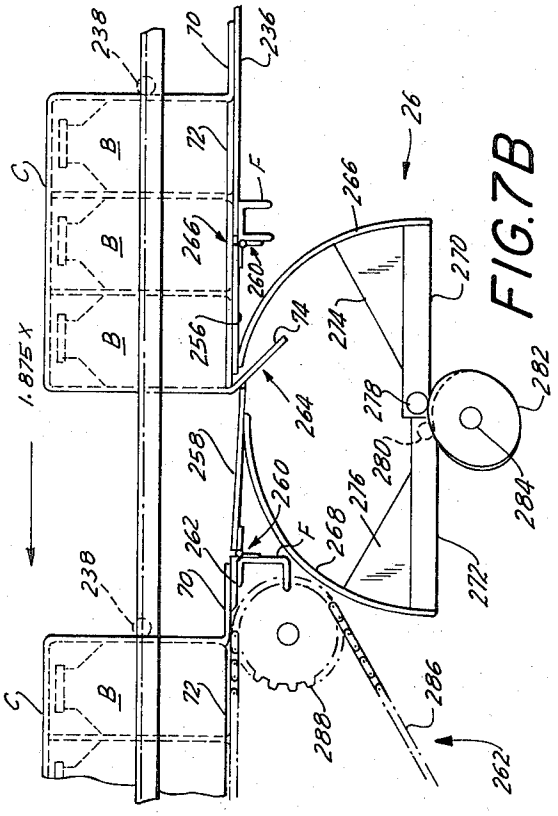


FIG.7B

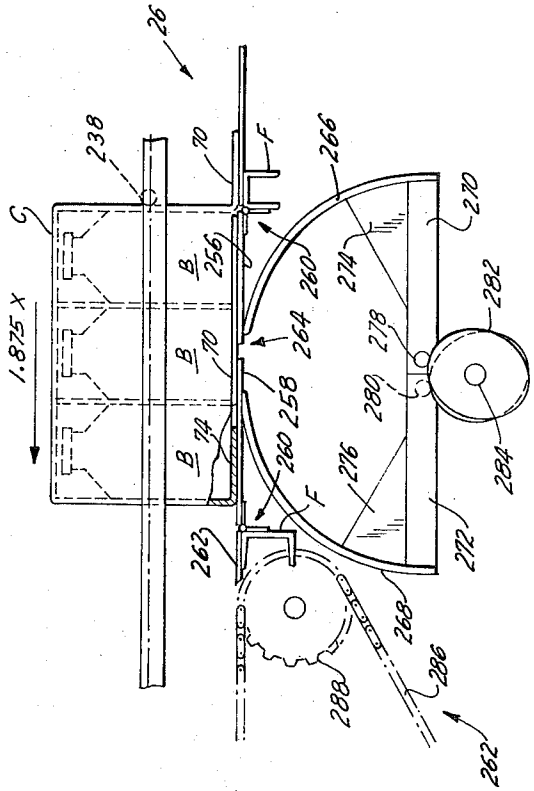


FIG.7C

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FIG.8A

FIG.8B

FIG.8C

FIG.8D

FIG.8E

FIG.8F

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HIGH SPEED AUTOMATIC CASING MACHINE

This invention relates to apparatus for packing articles into cases for shipment. More particularly, the invention provides an improved arrangement of apparatus adapted to receive a steady stream of articles and open cartons and to pack the cartons with the proper number of articles and properly seal same for shipment, all in a generally continuous automatic fashion at unusually high speeds.

One of the primary factors in the success of a manufacturing or wholesaling operation is the ability to quickly and effectively package the product for shipment. With the increasingly improved techniques for the high speed manufacture and packaging of consumer goods, it has been found that the most common impediment to high production output is the inability of the present methods and equipment to rapidly and effectively pack the finished product in cases for shipment at a speed commensurate with the product output capability of the plant. This is particularly true of the beverage industry where great strides have been made in high speed techniques for dispensing the product into consumer sized containers.

It will be readily appreciated that any case packing system to be effective must combine high speed with reliability and effective maintenance techniques. Thus, for a plant having a limited storage capacity the rate of production output is directly limited by the case packing capability of the plant.

In the past the packing of articles such as containers for shipment was generally accomplished manually at reasonable cost as a result of the limited production capability of most plants. More recently, in response to improved mass production techniques, increased labor costs, and today's generally expanded production facilities, apparatus has been designed to automatically accomplish this task. To date, however, machines of this type have been extremely complex and costly while not providing the increased speed and capacity to justify that increased cost. Moreover, conventional apparatus of this type almost universally suffers the drawbacks of frequent breakdowns of parts not readily susceptible to rapid maintenance and replacement. As a result of such breakdowns combined with the limited storage capacity of most plants, not only the case packing apparatus but also the production facilities must be shut down for substantial periods with an accompanying waste of equipment and manpower which generally far outweighs any savings in labor costs from the use of such automatic case packing apparatus.

A second drawback of prior art apparatus of this type is that they generally do not perform the entire operation of packing for shipment. Thus the cases are typically packed with the product automatically and then must be manually closed and sealed by tape or the like. Consequently, the ultimate speed attainable is still dependent on manual speed and dexterity, a factor which may fluctuate considerably. Accordingly, the automatic apparatus generally must be stopped frequently to account for fluctuations in manpower and efficiency at the output end of the operation.

Even where automatic apparatus for closing and sealing cartons for shipping is provided, such apparatus is often completely separate from the actual case packing equipment and is not properly coordinated therewith, thereby necessitating lengthy conveyor lines which take up considerable plant space.

Finally, apparatus of this type, by its very nature, requires substantial electrical power during operation. Thus, if for some reason the production rate drops, the continued high speed operation of the case packing apparatus involves considerable waste of power and unnecessary wear on the equipment. Yet, prior art apparatus of this type generally provides no flexibility in speed of operation. As a result, if such unnecessary power consumption and wear is to be avoided, the equipment must be operated intermittently provided adequate space is available to accommodate the product buildup between high speed case packing operations. The resulting inefficiencies and increased manpower requirement involved in such intermittent operation will be apparent.

It is a primary object of the present invention to design an automatic case packing apparatus which substantially eliminates the aforementioned drawbacks of prior art equipment of this type.

It is another object of the present invention to design apparatus adapted to pack cartons with a designated number of articles and close and seal the carton flaps, all in a substantially continuous, automatic and efficient manner at unusually high speeds.

It is yet another object of the present invention to provide apparatus adapted to receive a continuous flow of cartons and a continuous flow of articles, arrange said articles in appropriate groups and properly space same, position said groups in said cartons, and close and seal said cartons, all during substantially continuous high speed movement along a straight line conveyor system in an accurately timed automatic manner.

It is still another object of the present invention to provide apparatus of the type described which provides a timed sequential high speed packing operation utilizing relatively simple mechanical components which are easy to maintain, repair and replace and which are interconnected mechanically to insure a foolproof operation without the need for complex electrical switching mechanisms and circuitry.

It is yet a further object of the present invention to provide case packing apparatus of the type described which is provided with means to accurately adjust speed of operation over a wide range with no loss of timing accuracy.

It is a further object of the present invention to provide an improved case packing apparatus which is inexpensive to manufacture and reliable in operation and which may be readily installed for use with standard production output equipment in a relatively small plant space.

To these ends, the present invention comprises case packing apparatus utilizing a straight line conveyor system and adapted to perform 10 distinct operations in accurately timed sequence to produce packed cases ready for shipment.

The containers are fed into the aparatus in a single row at the inlet section. In the same general area and directly above the container infeed line, empty cartons enter the apparatus with the bottom front flap closed and the bottom back and side flaps open.

During the first operation the cartons are released in timed sequence by an indexing timer and conveyed by means of a flight bar, mechanically linked to the timer,

across a dead plate having means to fold open the front flap of the carton (the second operation).

Simultaneously in this general area, the containers are converted from a single row into a double row (third operation) and thereafter conveyed by a flat top divided chain conveyor in preparation for the fourth operation.

The fourth oepration comprises separating the containers into appropriate groups by means of a pair of timed indexing chains. The indexing chains run in a continuous loop on opposite sides of the line conveyor and are provided with spaced indexing fingers adapted to be received between adjacent containers. The cartons are simultaneously conveyed to a position directly above the thus grouped containers at a packing station, one carton arriving at the packing station precisely at the moment of alignment of one group of containers therewith.

The packing station comprises a second dead plate provided with an aperture adapted to receive a carton therethrough. Means in the form of a pair of parallel rotating members mechanically linked to the carton conveyor system are provided for pushing the carton through the aperture in the second dead plate, partially over the aligned group of containers (operation 5). During this operation the side flaps of the carton are automatically turned up as they pass through the aperture.

As the containers clear the indexing fingers, the carton is pushed down the remaining distance to the conveyor by means of a rotating roller bar also mechanically linked to the conveyor system (operation 6).

The carton is then conveyed past a front flap closer which, by means of a pair of timed reciprocating plates, is effective to turn in the front flap of the carton as it passes thereover (operation 7). Next the rear flap is turned under by means of a unique hinge plate on the conveyor chain in combination with a timed holdback mechanism (operation 8).

Finally, the cartons are conveyed past a conventional gluing station and side flap closing device whereby the side flaps are glued and turned in to seal the carton for shipping (operations 9 and 10).

The above operations are performed continuously in sequence at a rapid but adjustable pace along a straight line conveyor system within a relatively short space. The operative mechanisms are all mechanically linked to insure proper sequence and timing without complicated electronic circuitry.

To the accomplishment of the above and to such other objects as may hereinafter appear, the present invention relates to an automatic case packing apparatus as defined in the appended claims and as described herein with reference to the accompanying drawings, in which:

FIGS. 1A and 1B together are a front elevational view of the complete case packing apparatus, FIG. 1A generally illustrating operational areas I–V and FIG. 1B generally illustrating operational areas VI–X;

FIGS. 2A–2F are fragmentary front elevational views of area II of the case packing apparatus of FIG. 1A and illustrate in sequence the front flap opening operation;

FIG. 2G is a top plan view of the front flap opening mechanism in the position shown in FIG. 2E;

FIG. 3 is a top plan view of the container conveyor in area III of FIG. 1A schematically illustrating a mechanism for dividing the bottles from a single row into a double row;

FIG. 4 is a top plan view of the container conveyor in area IV showing the container indexing mechanism;

FIGS. 5A–5D are side elevational views of area V of the case packing apparatus of FIG. 1A illustrating in detail the sequential operation of the carton pushdown mechanism;

FIGS. 5E–5H are elevational views partly in section taken generally along the line 5—5 of FIG. 5A and showing generally the same sequence of events as shown in FIGS. 5A–5D;

FIGS. 6A–6C are front elevational views of the case packing apparatus generally in area VI of FIG. 1B and showing the sequential operation of the second pushdown mechanism;

FIGS. 7A–7C are front elevational views of the case packing apparatus of FIG. 1B generally in area VII and showing the sequential operation of the front flap closing mechanism;

FIGS. 8A–8F are front elevational views of the case packing apparatus of FIG. 1B generally in area VIII and showing the sequential operation of the rear flap turning mechanism; and

FIG. 8G is an enlarged front elevational view of the conveyor chain of FIGS. 8A–8F showing a hinged link utilized in the rear flap turning operation.

The purpose of the casing machine here illustrated is to automatically place filled and capped containers, here shown in the form of bottles, into a shipping carton and to seal said carton in preparation for shipment. It will be appreciated, however, that the basic machine may be modified to accommodate containers or other articles of various sizes and shapes and cartons of various constructions. The apparatus is generally driven by variable speed pulley mechanisms and is capable of operating at a wide range of speeds up to an in excess of 50 cartons per minute.

The basic operation of the machine is generally illustrated in FIGS. 1A and 1B, which together show the entire sequence of operations which take place at the various locations along the conveyor system. These various stations or locations of the machine are designated by Roman numerals I–X and correspond to the 10 distinct operations performed by the machine. As there shown in area I the containers are fed into the machine in a single row by a straight line conveyor, and are maintained thereon in an upright position. In the same general area and spaced above the bottles, the cartons are fed into the machine by a smooth flat belt conveyor generally downwardly inclined toward the container conveyor.

The empty cartons enter the machine with the bottom front flap closed and the bottom back and side flaps open. All top flaps are preferably closed an preglued, although it will be apparent that the machine may be modified to accomplish this operation also. In addition, only slight modifications in the machine need be made to accept incoming cases with bottom flaps in any position. The machine here illustrated is adapted to accept cartons either with all flaps out or with both front and/or back flaps closed and side flaps open.

The timing sequence of the machine is established at the inlet end in area I by an indexing timer generally designated 12 which releases one case at a time in timed coordination with a first flight bar conveyor sys-

tem generally designated **14.** The indexing timer is mechanically linked with the flight bar conveyor system such that the cartons are released between flight bars. The cartons are subsequently picked up by the flight bars and carried at a designated speed into area II. In this area the front flap is turned outward by a front flap opening mechanism generally designated **16** and illustrated schematically in FIGS. **2A–2F.** In addition, if the rear flaps are initially turned under, during this operation, they are automatically turned out.

The containers in area III on the container conveyor are divided from a single row into a double row by a suitable conventional divider mechanism generally designated **18** and are thereafter conveyed by a divided conveyor chain to the next station in area IV. As the containers enter area IV, they are separated into appropriate groups necessary to fill the cartons. This grouping operation is carried out by an indexing mechanism generally designated **20** which is continuously active on the incoming bottles at their bottom ends. As a result of the coordinated speed of the cartons and containers, a carton and a group of containers simultaneously move into alignment in registration with a first pushdown mechanism generally designated **22** in area V.

Pushdown mechanism **22** is effective to engage the top of the carton and push it down over the containers at the exact moment of alignment therewith, the cartons being received through an appropriate opening in the carton conveyor line. During this operation, the side flaps are automatically turned up as the carton passes through the opening. The pushdown mechanism **22** is so designed that when a carton is pushed down through the opening in the conveyor system to its lowest point, it is a short distance above the indexing mechanism **20.** Subsequently the indexing mechanism is disengaged from the grouped containers and the carton and containers are together moved to area VI illustrated in FIG. **1B.**

A second pushdown mechanism generally designated **24** in area VI is effective to fully depress the carton onto the bottles. After the carton has been pushed down completely, it is conveyed by a second flight bar system mechanically linked to the pushdown mechanism **24** past area VII where the front flap is turned inwardly by a timed reciprocating front flap closing mechanism generally designated **26.**

The carton then continues to be moved by the flight bar system into area VIII where a rear flap turning mechanism generally designated **27** is effective to close the rear flap. The carton is then conveyed by the same flight bar system into area IX past a conventional gluing mechanism **28** and thence into area X in which the side flaps are turned inwardly and sealed by the mechanism generally designated **30.**

The cartons, filled and cased with all flaps turned under and sealed, leave the flight bar system and are conveyed on a conventional table top chain conveyor toward the shipping area.

The above operations are carried out continusouly, each operation being performed in sequence as a result of a series of mechanically linked pulley systems. The operational system responds automatically to variations in input rate, may be adjusted to perform over a wide range of speeds, and as a result of the simplicity of design and the use of a minimum of electronic components is virtually immune to serious breakdowns.

Since the speed of operation or output rate of the machine herein specifically described is variable, an arbitrary unit of speed designated X will be used throughout this specification to indicate the relative speeds of the various mechanisms involved. In addition the apparatus described herein consists of a great number of belts, pulleys, chains and sprocket wheels. It will be appreciated that belts and pulleys are generally interchangeable with chains and sprocket wheels. Moreover, even when not specifically described conveyor belts are generally driven through chains and sprocket wheels at either side thereof.

In addition where two or more belts or chains are trained around pulleys or sprocket wheels mounted on a common shaft that arrangement is frequently illustrated and described as a single pulley or wheel over which the various belts or chains ride.

Referring again to FIG. **1A,** a plurality of containers there shown in the form of bottles B are disposed at the input of the device maintained in a single row on an input table top sprocket chain conveyor **32** by suitable guide rails **33.** Input conveyor **32** is mounted for continuous movement on sprocket wheels **34** and **36** which are in turn driven through a chain **35** and sprocket wheel **37** by suitable variable speed drive means (not shown). Wheels **34** and **36** and the various other structural components of the system are mounted on a suitable framework generally designated F and generally comprising a series of upright and transverse beams and trusses. Since the framework F is strictly conventional and forms no part of the present invention it will not be described further. In operation, the sprocket wheels **34** and **36** are driven at a constant rate, imparting a constant linear speed to the conveyor **32** and bottles B. It will be noted at this point the input speed of bottles B is not critical since the function of input bottle conveyor **32** is merely to create line pressure. Accordingly this conveyor may be driven by a separate drive motor and as will be apparent hereinafter should be driven at a speed of at least **2X.**

Mounted on framework F directly above input chain conveyor **32** is a smooth flat belt conveyor **38.** Conveyor belt **38** is trained in the usual endless loop over pulleys **39** and **40** respectively and along its lower flight is trained over pulleys **41** and **42** and under pulley **43.** A sprocket wheel is mounted fast with pulley **40** and a pair of sprocket chains **45** is trained over that wheel and another sprocket wheel **46** mounted further along the carton conveyor system in Area II. A third sprocket wheel **47** is mounted still further along the conveyor system in Area II and a second pair of sprocket chains **48** is trained over sprocket wheels **46** and **47** and moves in an endless path therebetween.

The entire system of belts and chains described above is driven by the pulley system generally designated **49.** That system comprises a drive pulley **50** mounted fast on a drive shaft **51** below the bottle conveyor line, an idler shaft **52** mounted on framework F between the upper and lower flights of the flight bar conveyor **14** and a pair of idler pulleys **54** and **56** both mounted fast on idler shaft **52.** A drive belt **58** is trained over drive pulley **50,** idler pulley **54** and a freely rotatable roller **60** and is effective to drive idler shaft **52.** A second belt **62** is trained around pulley **56** and a pulley **64** mounted fast with sprocket wheel **47** and is effective to drive that sprocket wheel. The drive shaft is driven by a variable speed drive motor (not shown)

which comprises one of two main drive motors for the machine.

The cartons generally designated C enter the machine from the right (as viewed in FIG. 1) in the inclined direction of arrow **66** and are conveyed on belt **38** between suitable guide rails **68** at a constant speed of 3X. The cartons C are empty as they enter the machine, with the top flaps preferably closed and preglued. Those empty cartons C will normally be the same cartons in which the empty bottles B were shipped to the contents manufacturer from the bottle manufacturer. Accordingly, the position of the bottom flaps is determined by the initial decasing operation. The cartons are here illustrated with the bottom rear flap **70** and side flaps **72** out (open) and the bottom front flap **74** in (closed). However, as will hereinafter become apparent, the machine as shown, with no modifications, is also adapted to receive cartons with all flaps out or with both front and rear flaps in and side flaps out. Moreover, only slight modifications are required to adapt the machine to accept incoming cartons with bottom flaps in any condition.

The cartons C pile up at the indexing timer **12** which releases the cartons one at a time in timed sequence with flight bar system **14.** Timer **12** may be any conventional carton release mechanism but is preferably a Standard Knapp Indexing Timer, well known in the art. As shown in FIG. **1,** flight bar system **14** comprises a plurality of horizontally disposed flight bars **76** mounted in evenly spaced relationship along a suitable sprocket chain conveyor **78.** That sprocket chain conveyor is trained around a series of idler wheels designated in a clockwise direction, **80, 82, 84, 86, 88** and **90,** respectively, and is driven through a sprocket wheel **92** (between wheels **80** and **90**) mounted fast on idler shaft **52.** Accordingly, the flight bar conveyor is mechanically linked to the carton conveyor and the speed ratio between the two is two to one, the flight bar conveyor travelling at half the speed (1½X) of the carton conveyor **38.**

As a flight bar **76** comes off idler wheel **80** it commences its operative lower flight parallel to but spaced from the inclined carton conveyor line. The indexing timer **12** is mechanically linked to the flight bar sprocket drive in a one to one ratio in well known manner so that each time a flight bar reaches the starting position of its lower flight (illustrated in FIG. **1A** by the flight bar designated **76***a*) a carton C is released by the indexer **12.** That carton C follows the flight bar **76** as long as it is on the conveyor belt **38** (the carton C travelling at twice the speed of the flight bar **76**). A dead plate generally designated **94** is virtually coterminous with the upper flight of conveyor belt **38** above sprocket chain **45** in area II and at its turned down inlet edge **94***a* receives the carton C as it comes off belt **38.** Accordingly the carton C momentarily stops on dead plate **94** and the preceding flight bar **76** moves away from the carton C while it is stationary. The carton C remains stationary on dead plate **94** until the next flight bar **76** catches up to it whereupon that carton C is now moved along dead plate **94** by the flight bar **76** at a speed of 1½X to area II.

As best shown in FIG. **2G,** the dead plate **94** in area II is provided with a generally rectangular opening **98** slightly wider than carton C and extending generally in the direction of movement of carton C. Accordingly, that opening **98** is sufficiently wide to allow the front flap **74** of the carton C to fall therethrough (see FIG. **2B**) but small enough to maintain the carton vertically supported on its side flaps **72** as it traverses the opening.

It is in this area (II) that the front flap is turned out by mechanism **16.** That operation is shown schematically in sequence in FIGS. **2A–2F.** As shown in FIGS. **2A** and **2B,** as the edge of the front flap **74** passes over the front edge **98***a* of the opening **98** in dead plate **94,** it drops into that opening as a result of its natural resiliency. In order to insure that the carton C is aligned with the opening **98** in dead plate **94,** a pair of pivotally mounted resilient guide bars **100** are provided at either side of opening **98** and are resiliently urged into lateral guiding, engagement with the carton C. As best illustrated in FIG. **2G,** those guide bars are pivotally mounted on vertical axes at **102** in any suitable manner and may be resiliently urged inwardly toward carton C by any suitable means such for example as coil springs **104** (FIG. **2A**). In addition, as illustrated in FIG. **1A** a top guide plate **106** is provided in area II extending parallel to the carton conveyor line and properly spaced thereabove adapted to engage the top of the carton C and thereby to maintain the side flaps **72** horizontally disposed on the dead plate **94** at either side of opening **98.** Top guide plate **106** is turned up at its inlet end **106a** to guide cartons C thereunder.

Referring again to FIG. **2A,** a cleat generally designated **108** is mounted between the sprocket chains **48** for movement therewith. As best shown in FIG. **2G,** cleat **108** is in the form of a rectangular plate mounted along one edge on a rod **110.** Rod **110** is journaled in registering links on sprocket chains **48** and is provided with means (not shown) to resiliently bias the plate **108** into the position shown in FIG. **2A** wherein the cleat **108** lies flat with the chains **48.** Accordingly, the cleat is moved along the lower flight of sprocket chains **48** over sprocket wheels **46** and onto the upper flight of the chains in a counterclockwise direction indicated by arrow **112.** As illustrated in FIGS. **2E, 2D** and **2G,** a cam **114** is mounted fast on one end of rod **110,** that end extending outwardly beyond sprocket chain **48.** A stationary rod or projection **116** is mounted in the path of cam **114** just prior to its turn over that sprocket wheel near the left hand edge of opening **98.** As illustrated in FIGS. **2D** and **2E,** cam **114** is so shaped that as its cam surface engages projection **116,** it is effective to pivot cleat **108** in the counterclockwise direction upwardly through opening **98.**

It will be recalled from FIG. **1A,** that the sprocket wheel **47** is driven through the same pulley system **49** which drives the flight bar conveyor **78.** The speed ratio between the two is preferably four to three — that is, while the flight bars move in the direction of arrow **118** at a speed of 1½X, the chain **48** is driven around sprocket wheels **46** and **47** in the direction of arrow **112** at a speed of 2X.

The operation will now be apparent from a consideration of the sequence illustrated in FIGS. **2A–2F.** As the carton C moves past the front edge **98***a* of the opening **98** in the dead plate **94** at a speed of 1½X, its front flap **74** falls through the opening (FIG. **2B**). Immediately following this occurrence, the cleat **108** which is moving at a speed of 2X passes below the edge **98***a* of opening **98** and is thus disposed behind the downwardly extending front flap **74.** About midway along opening **98** the cleat **108** at its pivot axis engages the front flap

74 and begins pivoting that flap in the clockwise direction as a result of the speed differential between the carton C and the cleat 108 (FIG. 2C). By the time the flap reaches the end of opening 98 it has been pivoted by cleat 108 to a substantially horizontal position (FIG. 2D). At this point, the cam 114 on pivot rod 110 engages the fixed rod 116 and the cleat 108 is momentarily pivoted upwardly in a counterclockwise direction above the plane of the dead plate 94 as illustrated in FIG. 2E. As there shown, the cleat 108, in this position, is effective to lift the flap 74 upwardly sufficiently to clear the rear edge 98*b* of the opening 98. The advancement of the carton C by the flight bar 76 is effective to carry the flap 74 beyond the rear edge 98*b* of the dead plate 94 whereupon the cam 114 drops off the fixed rod 116 and cleat 108 turns on sprocket wheels 47 and pivots back to its normal position flat with chains 48 (FIG. 2F). In order to provide clearance for cleat 108 during this operation the rear edge 98*b* of opening 98 is formed with a small recess 98*c*. Also during this operation the spring load side guide bars 100 serve to prevent the carton C from being pushed ahead and away from its associated flight bar 76 when the cleat 108 engages the flap 74.

As best shown in FIG. 3, as the containers enter area III they are divided from a single row into a double row by a divider mechanism there schematically illustrated and designated 118. Divider mechanism 118 may be a simple timed gating mechanism as there schematically illustrated but is preferably a Braren Divider manufactured by Standard Knapp Corp. under that name.

The bottles B are conveyed along the flat top conveyor 32 on either side of a divider rail 120 to area IV for separation into appropriate groups by indexing mechanism 20. The thickness of rail 120 preferably corresponds to the thickness of the partition elements used in the cartons C. As best shown in FIG. 1A prior to entering area IV the tops of the bottles engage and trip a normally open limit switch 122 which is effective to shut off the main drive motor (driving shaft 51) if there are no bottles on the conveyor at this position. This shut off procedure insures that there will be sufficient line pressure to push the bottles across a dead plate 124 disposed at the far end of flat top conveyor 32.

The bottles B are pushed from dead plate 124 onto a second flat top chain conveyor generally designated 126. As shown in FIG. 1A that conveyor comprises a belt 128 trained around pulleys 130 and 132. The conveyor 126 is mechanically linked to the flight bar conveyor system 14 by means of the pulley system generally designated 134, and is driven thereby. Pulley system 134 comprises a belt 136 trained around pulley 86 of the flight bar system at one end and around pulley 132 at its other end. The relative dimensions of these pulleys are such as to drive conveyor belt 128 at a speed two-thirds that of the flight bar conveyor 78. Thus while the flight bar conveyor belt 78 is traveling at a speed of 1½X the bottle conveyor belt 128 travels at a speed of X. The change of bottle speed from 2X on conveyor 32 to X on conveyor 128 ensures that the bottles are lined up contiguously as a result of line pressure for the indexing operation to follow.

As best shown in FIG. 4 the indexing mechanism 20 comprises a pair of roller chains 138 disposed at either side of conveyor belt 128 and mounting a plurality of evenly spaced indexing fingers 140 therealong. The chains 138 run in a continuous loop in the directions indicated by arrows 142 along sprocket wheels 144, 146, 148, 150 and 152 in that order. The operative portion of the loop is defined on the side nearest the conveyor belt 128 between sprocket wheels 146 and 150. As the chains come off the sprocket wheels 146 they are traveling in the same direction as the bottles B but at a slight angle inwardly towards those bottles. The indexing fingers are slightly tapered at their ends and are thus adapted, as they approach the bottles, to enter the joint between successive bottles in each row, thereby separating successive bottles by a distance equal to the operative width of the fingers. Purely for purposes of illustration it has been assumed that each carton C is adapted to accommodate six bottles in two rows of three. Accordingly, every third indexing finger 140 is here shown formed with an increased thickness, thereby to separate the bottles into groups G of two rows of three each. These indexers of greater thickness are spaced from one another by a distance substantially equal to the length of cartons C. The thickness of the remaining index fingers 140 preferably corresponds substantially to the thickness of the internal partition members utilized within the cartons C.

The thus indexed groups G of bottles b are moved along the conveyor belt 128 between sprocket wheels 148 and 150 with the indexing fingers spaced therebetween, the chains 138 running substantially parallel to the conveyor between these two sprocket wheels. When the indexing chains 138 reach the sprocket wheels 150 the drains turn outwardly around wheels 150 and diverge outwardly toward sprocket wheels 152, indexing fingers 140 disengaging from the bottles. The sprocket wheels 144–152 are preferably all idler sprocket wheels, the chains 138 being moved by the bottles B themselves as a result of the back pressure created by the greater speed 2X of the input conveyor belt 32 relative to that of belt 128 (X). Thus for initial start up, it is necessary to manually place the first few bottles B between successive index fingers in properly indexed relationship. Once this is done the back pressure on the bottle conveyor line is effective to provide automatic indexing, the motive force for the indexing operation being the conveyor belt 128. As the properly indexed group of bottles B passes the sprocket wheels 150, and the index fingers are released therefrom, the bottles remain in their properly indexed spaced relationship since there is no back pressure at this point.

Referring again to FIG. 1A, the cartons C which are traveling at 1½ times the speed of the indexed bottles are moved from area II with all flaps out along the downward incline of dead plate 94 and onto a horizontal portion of that dead plate in area V by the flight bars 76. The spacing of flight bars 76 is 1½ times greater than the grouping space G of the bottles B — that is, 1½ times the distance from one of the thick index fingers to the next. As a result of this spacing and the relative speeds of the flight bar conveyor 78 and the bottle conveyor 128, each carton moves into alignment with a properly indexed group of bottles B at a particular location here designated as area V.

As best shown in FIG. 5A, dead plate 94 in this area is provided with a second opening generally designated 154. As best shown in FIGS. 5E–5G, that opening 154 is wide enough to receive a carton C therethrough if the side flaps 72 are turned up. Accordingly, at the moment of alignment between a carton C and a group G

of bottles B the carton C, which is disposed directly over opening **154**, is pushed down over a group of bottles by pushdown mechanism **22**. As best shown in FIG. **5A** that mechanism comprises a pair of pushdown rollers **156** and **158** freely rotatably mounted between bracket arms **160** and **162**, respectively. Those bracket arms are in turn pivotally mounted at their other ends on spaced shafts **164** and **166**, respectively. Those shafts are each driven by a pulley system **168** and **170** respectively, which are mechanically linked to the flight bar conveyor system **14**. Pulley system **168** comprises a pulley **172** mounted fast on shaft **164** and drivingly connected by means of a belt **176** to a pulley **174** mounted fast with sprocket wheel **84**, and pulley system **170** comprises a pulley **178** mounted fast on shaft **166** and mechanically linked to pulley **174** by means of a belt **180**. Accordingly, the pushdown rollers **156** and **158** are mechanically timed to engage the top of a carton and push it down over the bottles at the exact moment the carton is aligned with the bottles at a frequency precisely equal to the frequency at which the cartons are moved over aperture **154** in dead plate **94**.

As best shown in FIGS. **5E–5G**, the opening **154** at either side thereof is provided with a pair of narrow strips **182** pivotally mounted at **184** and extending substantially along the entire length of the opposing lateral edges of opening **154**. Those strips **182** are preferably spring biased to the horizontal position illustrated in FIG. **5E** by any suitable means such as spring hinges **186** whereby the strips **182** are effective to restrict the width of the opening.

As a carton is pushed downwardly by rollers **156** and **158**, those strips **182** pivot downwardly and outwardly as shown in FIG. **5F** to allow the carton to be pushed through the opening **154**, the strips **182** snugly engaging the side flaps **72** and maintaining those flaps in the vertical position illustrated in FIG. **5F** until the carton is partially covering a group of bottles. As best shown in FIG. **5G** the flaps **72** at that point, by virtue of their natural resiliency, pivot outwardly and engage a pair of L-shaped brackets **188** provided for that purpose. Strips **182** and brackets **188** ensure that the side flaps **72** are not turned down prematurely before the carton is pushed down fully by rollers **156** and **158** to the position shown in FIG. **5H**. As there shown, as the carton approaches this position, the side flaps **72** of the carton C are released from brackets **188** and are received on support plates **190**. As best shown in FIGS. **5F** and **5C**, those plates **190** are mounted on framework F at either side of bottles B and comprise a horizontal support portion **192** disposed directly over sprocket wheels **150** and extending laterally over indexing fingers **140** and an inclined portion **194** extending downwardly to the right (FIG. **5C**) to the level of the bottle conveyor belt **128** just to the left of sprocket wheel **130**. Thus the leading edges of side flaps **72** as they are released from brackets **188**, engage the horizontal support portions **192** of plates **190**, and thus the carton is maintained spaced above the outlet end of indexing mechanism **22** until the group of bottles clear said mechanism.

As best illustrated in FIGS. **5A–5D**, just prior to the withdrawal of the indexing fingers **140** from between the bottles B in the area of sprocket wheels **150**, the indexed bottles are pushed across another dead plate **196** onto another flat top chain conveyor **197** by the line pressure. As best seen in FIGS. **1A** and **1B**, that conveyor comprises a belt **198** trained around wheels **200** (FIG. **1A**) and **202** (FIG. **1B**). That conveyor **197** by means of a pulley system generally designated **206**, is operatively drivingly connected to sprocket wheel **130** and thus bottle conveyor **126**, flight bar conveyor **14** (through pulley system **134**) and carton conveyor **27** (through pulley system **49**). Pulley system **206** comprises an idler shaft **208** rotatably mounted on framework F upon which shaft two pulleys **210** and **212** are mounted fast. A drive belt **214** is trained around wheel **202** at one end and around pulley **212** at its other end, idler pulley **216** taking up the slack. Another belt **218** drivingly connects pulley **210** to an idler pulley **220** mounted on framework F below wheel **200**. That idler pulley is in turn operatively drivingly connected to wheel **130**, which drives bottle conveyor belt **128**, by another belt **222**. By virtue of the above conveyor belt **198** is driven at a speed of 2X.

Referring again to FIGS. **5A–5D**, it will be seen that a new carton C2 approaches the leading edge **154***a* of opening **154** in dead plate **94** just as a previous carton C1 has completed its downward movement over a group of bottles (FIG. **5A**). An upper guide plate **224** is provided at this location above the leading edge **154***a* of opening **154** to ensure that the carton C remains horizontal, the motivating flight bar **76** at this point moving downwardly relative to carton C2 as a result of the incline of conveyor **78**. The pushdown rollers **164** and **166** engage the top of the carton C2 simultaneously as the rear side wall of the carton C2 clears the leading edge of the aperture **158***a*. Since the flight bar conveyor is moving at one and one half times the speed of the indexed bottles B below opening **154**, the carton C2 has at this point caught up with the previous carton C1 and the front flap **74** of carton C2 is generally aligned with the rear wall of carton C1 therebelow (see FIG. **5B**). At the moment of roller engagement (FIG. **5B**) the flight bar begins to turn around sprocket wheel **82**. Accordingly, the horizontal (leftward) component of flight bar velocity at this point begins progressively to decrease.

As the carton is pushed down to a position just clearing the necks of the bottles B as illustrated in FIG. **5C**, the carton C2 is traveling to the left at approximately the same speed (X) as the bottles B. Moreover, once the lower edge of the carton C2 clears the necks of the bottles B, the carton is self-centering on the group of bottles. Thus during the remainder of the downward travel of carton C2 the partition elements **226** automatically seek the spaces **228** between the still indexed bottles B defined by the index fingers **140** and this self-aligning process is unimpeded by the flight bar **76**, which, as the carton C2 engages the bottles B, has already moved upwardly along the vertical flight of conveyor **78** out of engagement with the carton. In addition, as shown in FIG. **5C**, as carton C2 is pushed down, its front flap **74** wipingly engages the rear wall of the preceding carton C2. This relative positioning is effective to prevent the front flap **74**, as a result of its natural resilience, from turning down and jamming against support plate **190**. However, during the pushdown of carton C2, carton C1, which is now moving along conveyor **196** at a speed (2X) twice that of carton C2 (X), moves away from carton C2. Thus before carton C2 reaches its lowermost position (FIG. **5D**) the preceding carton C1 has moved away from carton C2 sufficiently to prevent the front flap of carton C2 from jamming

against the rear of carton C1. As shown in FIG. 5D pushdown bracket arms 160 and 162 are of a length sufficient to push the carton down to the level of support plate 190 and no further. Moreover, opening 154 is long enough to accommodate the small horizontal movement of the carton to the left during the relatively rapid vertical pushdown movement.

Shortly after a carton is pushed down the index fingers are retracted from the group G of bottles B over which the carton is disposed, that group being pushed across dead plate 196 onto conveyor belt 198.

The bottles and carton are then conveyed at a speed of 2X along belt 198 to a second pushdown mechanism generally designated 228. As best shown in FIGS. 6A–6C, that mechanism comprises another roller bar 230 journalled at one end of a pair of bracket arms 232, the other ends of which are mounted fast on a rotatable drive shaft 234. The shaft is driven at an angular speed such that roller bar 230 revolves at a tangential velocity of 1.875X and is turned to engage the top of each carton approximately at the 3 o'clock position as illustrated in FIG. 6A. The carton C is pushed down completely until its lower edge is flush with conveyor belt 198 during a quarter revolution of roller 230 in the clockwise direction (FIG. 6B) just as the carton approaches the end of belt 198. At this point carton C is pushed onto another dead plate 236 and pauses momentarily until a flight bar 238 of a second flight bar conveyor system generally designated 240 engages its rear wall.

As best shown in FIG. 1B flight bar conveyor system 240 comprises a plurality of equally spaced bars 238 mounted between a pair of parallel roller chains 242. Those chains are moved in a counterclockwise direction by a sprocket wheel 244 mounted fast on shaft 234 and trained respectively around wheels 246, 248, 250, 252 and 254 and thence back around wheel 244. The radius of sprocket wheel 244 is exactly equal to the length of bracket arms 232 so that the flight bars 238 also move at a speed of 1.875X. Moreover, the spacing of the flight bars is such that a flight bar engages each carton shortly after it is deposited on dead plate 236 (see FIG. 6C).

In order to correlate the speed of flight bar conveyor 242 with that of conveyor belt 198 the two are preferably operatively drivingly connected by means such as chain 245 shown in FIG. 1B trained around wheels 202 and 246. However, it will be apparent that this speed correlation is not critical and consequently the flight bar system may be driven through a separate drive motor (not shown) at the required speed.

The carton C is then carried along dead plate 236 to the front flap closing mechanism 26 in Area VII (FIG. 1B). As best shown in FIGS. 7A–7C, that mechanism includes a pair of hinge plates 256 and 258, hinged at opposite ends along axes transverse to the direction of carton travel. The righthand plate 256 (as viewed in FIG. 7A) is hinged on framework F at the terminal edge of dead plate 236 by a suitable hinge mechanism 260 and the other plate 258 is also hinged on framework F at the front edge of another dead plate designated 262, the plates being slightly spaced at their free ends to define a narrow transverse slot 264 (see FIG. 7C). The hinge plates 256 and 258 are vertically supported near their free ends on a pair of arcuate cam arms 266 and 268 respectively. Thus hinge plate 256 is supported by its engagement with one end of support arm 266 and hinge plate 258 is supported by its engagement with one end of support arm 268. Support arms 266 and 268 in turn are mounted at their other ends on a pair of horizontally disposed cam arms 270 and 272 which when aligned as illustrated in FIG. 7C are generally coterminous. A pair of brackets 274 and 276 respectively are provided for additional support of arms 266 and 268. Cam arms 270 and 272 are mounted for vertical sliding movement by any suitable means (not shown) on framework F and are provided with horizontal cam follower rods 278 and 280, respectively, extending transversely in closely spaced parallel relationship from the contiguous ends of arms 270 and 272.

Cam follower rods 278 and 280 provide vertical support for cam arms 270 and 272 and thus support arms 274 and 276, respectively, by their engagement with an eccentric cam 282 mounted fast on a rotatably driven shaft 284. Shaft 284 is preferably mechanically linked (in any suitable manner) to the flight bar conveyor 240 to reciprocate arms 266 and 268 in timed relationship with the movement of cartons C past slot 264. Accordingly, during each complete rotation of cam 282, cam arms 270 and 272 and thus support arms 266 and 268 reciprocate in a manner illustrated in the sequence of FIGS. 7A–7C, thereby to reciprocate the hinge plates 256 and 258, respectively.

As there shown, as the front flap 74 of the carton C moves to the left off dead plate 236 and onto hinge plate 256, that hinge plate pivots slightly downwardly (counterclockwise) and the other hinge plate 258 pivots slightly upwardly, thereby to allow the flap 74 to enter the slot 264 therebetween (FIG. 7A). After the flap 74 has moved under the elevated hinge plate 258 and before the leading wall of the carton has reached the plate 258, that plate pivots downwardly with respect to plate 256, whereby as the leading wall of the carton moves past the slot 264, the free end of the now depressed hinge plate 258 engages flap 74 and pivots that flap counterclockwise, thereby to turn it in under carton C (FIG. 7B). As the carton C continues its movement to the left the front flap 74 moves out of slot 264 and onto hinge plate 258 in the turned in (closed) position.

As the carton C leaves hinge plate 258, it is carried by flight bar 238 across dead plate 262 toward the rear flap closing mechanism 27. As best shown in FIG. 1B, that mechanism includes a flat top chain conveyor belt 286 which moves counterclockwise around three sprocket wheels 288, 290 and 292. Sprocket wheel 288 is mounted just below dead plate 262 and defines the commencement of the horizontal flight 294 of the belt, that horizontal flight being generally coterminous with dead plate 262. The horizontal flight 294 terminates as the belt turns on sprocket wheel 290 spaced to the left of wheel 288. Wheel 290 is the driving sprocket wheel and is operatively drivingly connected through a belt 298 to sprocket wheel 254 of flight bar conveyor 240. Thus the belt 286 is mechanically linked to the flight bar conveyor and as here disclosed is driven at a speed of 3.75X (twice the speed of the flight bar conveyor 242).

As best illustrated in FIGS. 8A–8D, belt 286 comprises a series of contiguous metal strips 300 extending transversely between parallel roller chains 302 spaced by a distance greater than the width of the carton C. As illustrated in FIG. 1B, belt 286 is interrupted at two spaced locations therealong by hinged strips S. Those

strips are spaced along the belt **286** by a distance equal to one half the total length of the belt.

Referring now to FIG. **8G**, it will be seen that the hinged strips S are hinged along an axis **304** slightly below the level of the belt and accordingly the two strips **300** closest to that hinge are slightly bent downwardly to the right toward the hinge axis **304.** The hinged strips are normally biased into the slightly downwardly inclined position shown in FIG. **8A** in which they are coterminous with the bent strips **300** at their hinged end and slightly spaced from the following strip **300'** to define a slot **306.** The leading edge of strip **300** is bevelled as shown with a surface **308** inclined upwardly to the left. (See FIG. **8**).

There are two spring loaded pressure plates **310,** one on each side of carton C as it traverses conveyor belt **286.** The pressure plates **310** create friction against both sides of the carton, and that frictional force is of greater magnitude than the friction between the bottom of the cartons C (including the frictional engagement with bottles B) and the conveyor strips **300.** Accordingly, this side frictional resistance is effective to hold the carton C back against the flight bar **238** even though the conveyor **286** is moving at twice the speed (3.75X) of the flight bar **238** (1.875X). Since the carton is thus held back against the flight bar **238,** the slot **306** in the conveyor **286** overtakes the carton at a speed of 1.875X at a point which is predetermined by the mechanical pulley linkage between the conveyor **286** and the flight bar conveyor **240.** As the slot **306** approaches the rear flap **70** of the carton C that flap, as a result of its natural resiliency, pivots clockwise, dropping onto the incline formed by the bent strips **300** and the hinged strip S. As the conveyor **286** continues to advance (to the left) relative to the carton C, the rear flap passes under the bevelled conveyor strip **300** (FIG. **8C**) into the slot **306.** As the bevelled strip **300** approaches the hinge axis of the rear flap **70** (FIG. **8D**), the hinged strip, which is now directly under the rear bottle in the carton, is elevated by a camming mechanism similar to that used in the front flap closing mechanism **16** but not here specifically shown. The now elevated hinged strip S is effective to elevate the rear bottle B within the carton C while the bevelled strip **300** engages the rear flap **70** and pivots it clockwise under the carton (FIG. **8E**). The bevelled strip **300** then passes under the rear flap **70** in the turned in position and the hinged strip S moves to the left, being retracted from between the rear bottle B and the rear flap **70,** the rear bottle B now being supported on the rear flap **70** which in turn is supported on the strips **300** of conveyor belt **286** (FIG. **8F**). As the belt **286** turns around sprocket wheel **290** the carton is pushed onto another dead plate **312.** The leading edge **314** of that dead plate is bent downwardly to insure that the edge of the rear flap **70** is not jammed thereagainst. The timing of the flight bar conveyor **240** relative to the flap turning conveyor **286** is designed so that the front flap **74** moves onto dead plate **312** before the bevelled strip **300** reaches that flap, thereby to prevent the front flap **74** from being turned out.

The total length of the flap turning conveyor **286** is correlated with the spacing of the flight bars **238** such that two rear flaps of two cartons are turned in (by the two hinged strip arrangements) during each complete revolution of the conveyor **286.** In addition, as shown in FIG. **8B** when the rear flap **70** is aligned over the hinged strip S the flight bar **238** engages a limit switch (not shown) which is effective to actuate a solenoid valve (not shown) thereby to release a jet of air **314** from a nozzle **316** disposed over the cartons. The air jet **314** insures that the rear flap **70** falls onto the inclined hinged strip S.

As best illustrated in FIG. **1B**, the same flight bar continues to move the carton C along dead plate **312** past the flap gluing mechanism **28** and side flap turn-in mechanism **30.** Those mechanisms are schematically illustrated in FIG. **1B** but will not be here specifically described as they are in all respects conventional and well known. Typical mechanisms for this purpose are manufactured by Standard Knapp Corporation.

The cartons now filled with bottles and having all flaps turned under and glued are deposited at the outlet **318** of the machine by the flight bars **238** which continue around sprocket wheels **248** and **250** in an endless loop.

It will be appreciated from the foregoing that I have provided an automatic case packing apparatus of extremely versatile and reliable construction. The entire case packing operation is accomplished along a single conveyor line in a rapid and effective manner by mechanisms which are effectively operatively drivingly connected to one another, thereby to insure virtually foolproof operation. Moreover, by virtue of this mechanical drive linkage the apparatus may be driven at a wide range of speeds and has an output rate of up to 50 cartons per minute. The apparatus is thus adapted to adjust to variations in product output without the necessity of frequent shutdown.

While only a single embodiment of the present invention is herein disclosed, it will be appreciated that many variations may be made without departing from the spirit and scope of the invention, as defined in the appended claims.

I claim:

1. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons having front, rear and side flaps and to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, said machine comprising means at said carton inlet for receiving cartons having top flaps closed and at least said bottom side flaps open and for conveying same in spaced relationship past a flap opening station to said packing station, means at said flap opening station for opening said front and rear flaps on said carton if they are closed, said flap opening means comprising a dead plate upon which said cartons are adapted to be conveyed by said carton conveying means, said dead plate having an opening therein and means under said dead plate opening adapted to operatively engage said front flap through said opening and to pivot same to the open position as said carton moves past said opening, means for receiving a continuous stream of articles at said article inlet and for conveying same to a grouping station, means at said grouping station for separating said articles into groups adapted to fill said cartons, and for conveying the thus grouped articles to said packing station under said carton conveying means, means operatively drivingly connecting said carton conveying means to said article grouping means, whereby a group of articles is aligned at said packing station with a carton as it reaches said packing station, and means at said packing station, operatively con-

nected to said carton conveying means, for lowering a carton over a group of articles as it reaches said packing station.

2. The apparatus of claim 1, wherein said front flap engaging means comprises a cleat and further comprising endless cleat conveyor means for moving said cleat in an endless path under said opening in said dead plate thereby to engage the front flap of a carton each time a carton moves past said opening.

3. The apparatus of claim 2, wherein said endless cleat conveyor means is effective to move said cleat under said opening in substantially the direction of said carton movement but at a greater speed than said carton is moved, said cleat catching up to said front flap and engaging same through said opening.

4. The apparatus of claim 3, wherein said cleat is pivotally mounted on said endless conveying means and further comprising means for pivoting said cleat upwardly through said opening to raise said front flap above the level of said dead plate before said front flap reaches the end of said opening.

5. The apparatus of claim 4, wherein said pivoting means comprises cam means operatively connected to said cleat.

6. The apparatus of claim 1, further comprising carton indexing means, said carton conveying means further comprising carton inlet conveyor means at said carton inlet adapted to convey a continuous stream of cartons to said carton indexing means, a flight bar conveyor having a plurality of spaced flight bars adapted to engage said cartons on said dead plate, said carton indexing means being operatively connected to said flight bar conveyor and effective to release cartons in timed sequence with the movement of said flight bar conveyor, said carton inlet conveying means being effective to convey said released cartons to said dead plate, whereby one carton is deposited on said dead plate between the passage of consecutive flight bars thereover.

7. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons having front, rear and side flaps and to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, said machine comprising means at said carton inlet for receiving cartons having top flaps closed and at least said bottom side flaps open, means operatively engaging said cartons and effective to convey same in spaced relationship in a given direction past a flap opening station to said packing station, means at said flap opening station for opening said front and rear flaps on said carton if they are closed, means for receiving articles at said article inlet and for conveying same to a grouping station in a continuous stream moving in said given direction, means at said grouping station for separating said articles into groups adapted to fill said cartons while said articles continue to move in said given direction, and for conveying the thus grouped articles in said given direction to said packing station under said carton conveying means, means operatively drivingly connecting said carton conveying means to said article grouping means such that a group of articles and a carton reach said packing station simultaneously and are brought into momentary vertical alignment at said packing station, and means at said packing station, operatively connected to said carton conveying means, and effective to lower a carton over a group of articles at said packing station while said carton and said articles continue to move in said given direction, said carton conveying means remaining engaged with said carton until said carton is lowered into engagement with said group of articles.

8. The apparatus of claim 7, wherein said article grouping means comprises a plurality of article grouping fingers adapted to be inserted laterally between two consecutive articles on said article conveying means, said grouping fingers being mounted on endless finger conveyor means and spaced from each other such that when so inserted, one or more articles are positioned therebetween.

9. The apparatus of claim 8, wherein said articles are conveyed to said article grouping means in a double row, there being two of said endless finger conveying means disposed at opposite sides of said article conveyor and operatively engaging said two rows of articles, respectively.

10. The apparatus of claim 8, wherein said cartons are provided with internal partition means extending transversely to the direction of carton movement and wherein article spacing fingers are provided between said grouping fingers on said endless finger conveyor means, said spacing fingers being adapted to separate individual articles within a given group by a spacing generally corresponding to the thickness of said carton partition means.

11. The apparatus of claim 10, wherein said articles are conveyed to said article grouping means in a double row, there being two of said endless finger conveying means disposed at opposite sides of said article conveyor and operatively engaging said two rows of articles, respectively.

12. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons having front, rear and side flaps and to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, said machine comprising means at said carton inlet for receiving cartons having top flaps closed and at least said bottom side flaps open and for conveying same in spaced relationship past a flap opening station to said packing station, means at said flap opening station for opening said front and rear flaps on said carton if they are closed, means for receiving a continuous stream of articles at said article inlet and for conveying same to a grouping station, means at said grouping station for separating said articles into groups adapted to fill said cartons, and for conveying the thus grouped articles to said packing station under said carton conveying means, means operatively drivingly connecting said carton conveying means to said article grouping means, whereby a group of articles is aligned at said packing station with a carton as it reaches said packing station, and means at said packing station, operatively connected to said carton conveying means, for lowering a carton over a group of articles as it reaches said packing station, wherein said flap opening means comprises cleat means under said carton conveying means adapted to operatively engage said front flap, and means operatively connected to said carton conveying means for moving said cleat under said cartons in the same direction as the movement of said cartons but at an increased speed relative thereto, said cleat engages said front flap of a carton from the rear, thereby to pivot same to the open position.

13. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons having front, rear and side flaps and to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, said machine comprising means at said carton inlet for receiving cartons having top flaps closed and at least said bottom side flaps open and for conveying same in spaced relationship past a flap opening station to said packing station, means at said flap opening station for opening said front and rear flaps on said carton if they are closed, means for receiving a continuous stream of articles at said article inlet and for conveying same to a grouping station, means at said grouping station for separating said articles into groups adapted to fill said cartons, and for conveying the thus grouped articles to said packing station under said carton conveying means, means operatively drivingly connecting said carton conveying means to said article grouping means, whereby a group of articles is aligned at said packing station with a carton as it reaches said packing station, and means at said packing station, operatively connected to said carton conveying means, for lowering a carton over a group of articles as it reaches said packing station, wherein said cartons are conveyed to said packing station above said group of articles on support means, aperture means in said support means of a size and shape adapted to receive said cartons therethrough, yieldable holding means adapted to hold said carton above said aperture means and to yield upon forceful pushing of said cartons downwardly, said carton lowering means comprising carton pushdown means adapted to engage said carton and push it downwardly through said opening with sufficient force to cause said holding means to yield.

14. The apparatus of claim 13, wherein said pushdown means comprises rotary means having a pushing element adapted to engage a carton at a given point in its rotary path during each complete rotation of said rotary means, said rotary means being operatively drivingly connected to said carton conveying means whereby a carton is aligned over said aperture each time said pushing element reaches said given point.

15. The apparatus of claim 13, wherein said flap opening means comprises a dead plate upon which said cartons are adapted to be conveyed by said carton conveying means, said dead plate having an opening therein and means under said dead plate opening adapted to operatively engage said front flap through said opening and to pivot same to the open position as said carton moves past said opening.

16. The apparatus of claim 15, wherein said front flap engaging means comprises a cleat and further comprising endless cleat conveyor means for moving said cleat in an endless path under said opening in said dead plate thereby to engage the front flap of a carton each time a carton moves past said opening.

17. The apparatus of claim 16, wherein said endless cleat conveyor means is effective to move said cleat under said opening in substantially the direction of said carton movement but at a greater speed than said carton is moved, said cleat catching up to said front flap and engaging same through said opening.

18. The apparatus of claim 17, wherein said cleat is pivotally mounted on said endless conveying means and further comprising means for pivoting said cleat upwardly through said opening to raise said front flap above the level of said dead plate before said front flap reaches the end of said opening.

19. The apparatus of claim 18, wherein said pivoting means comprises cam means operatively connected to said cleat.

20. The apparatus of claim 13, further comprising carton indexing means, said carton conveying means further comprising carton inlet conveyor means at said carton inlet adapted to convey a continuous stream of cartons to said carton indexing means, a flight bar conveyer having a plurality of spaced flight bars adapted to engage said cartons on said dead plate, said carton indexing means being operatively connected to said flight bar conveyor and effective to release cartons in timed sequence with the movement of said flight bar conveyor, said carton inlet conveying means being effective to convey said released cartons to said dead plate, whereby one carton is deposited on said dead plate between the passage of consecutive flight bars thereover.

21. The apparatus of claim 13, wherein said flap opening means comprises cleat means under said carton conveying means adapted to operatively engage said front flap, and means operatively connected to said carton conveying means for moving said cleat under said cartons in the same direction as the movement of said cartons but at an increased speed relative thereto, said cleat engaging said front flap of a carton from the rear, thereby to pivot same to the open position.

22. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons having front, rear and side flaps and to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, said machine comprising means at said carton inlet for receiving cartons having top flaps closed and at least said bottom side flaps open and for conveying same in spaced relationship past a flap opening station to said packing station, means at said flap opening station for opening said front and rear flaps on said carton if they are closed, means for receiving a continuous stream of articles at said article inlet and for conveying same to a grouping station, means at said grouping station for separating said articles into groups adapted to fill said cartons, and for conveying the thus grouped articles to said packing station under said carton conveying means, means operatively drivingly connecting said carton conveying means to said article grouping means, whereby a group of articles is aligned at said packing station with a carton as it reaches said packing station, and means at said packing station, operatively connected to said carton conveying means, for lowering a carton over a group of articles as it reaches said packing station, further comprising second carton conveying means for conveying said filled carton along a support means past means for closing said front flap after said carton is lowered onto said group of articles, said support means having an opening, said front flap closing means comprising a pair of spaced reciprocating members in said opening defining a slot therebetween and means for reciprocating said spaced members to receive said front flap extending outwardly ahead of said carton in said slot in the direction of carton movement and to thereafter engage said front flap and pivot same inwardly toward the underside of said carton, said front flap leaving said slot in the closed position.

23. The apparatus of claim 22, wherein said reciprocating means comprises rotary cam means operatively drivingly connected to said second carton conveying means.

24. The apparatus of claim 22, further comprising means for closing said rear flap, said second carton conveying means conveying said carton successively past said front flap closing means and said rear flap closing means after said carton is lowered onto said group of articles.

25. The apparatus of claim 24, wherein said rear flap closing means comprises a movable member under said carton conveying means, means moving said movable member in the direction of movement of said second carton conveying means at a speed greater than the speed of said carton, said movable member including a pivotal member defining a slot in said moveable means, means to pivot said pivotal member downwardly away from said carton as said slot approaches said rear flap thereby to receive said rear flap in said slot, said movable means engaging said rear flap and pivoting same to the closed position as said slot moves past said flap, and means pivoting said pivotal member upwardly into said carton above the plane of said movable means as said slot moves away from said rear flap whereby said rear flap is retracted from said slot in the closed position.

26. The apparatus of claim 25, wherein said second carton conveying means is a flight bar engaging said carton at its rear, said movable means comprising vertical support means for said carton and further comprises holdback means effective to hold back said carton against said flight bar thereby to prevent said carton from being moved away from said flight bar by said movable support means.

27. The apparatus of claim 25, further comprising fluid spray means mounted above said cartons and adapted to spray a jet of fluid on said rear flap to press it against said pivotal element in its downwardly pivoted position thereby to facilitate entry of said rear flap into said slot.

28. The apparatus of claim 27, wherein said second carton conveying means is a flight bar engaging said carton at its rear, said movable means comprising vertical support means for said carton and further comprises holdback means effective to hold back said carton against said flight bar thereby to prevent said carton from being moved away from said flight bar by said movable support means.

29. The apparatus of claim 24, further comprising means along said second carton conveying means for applying adhesive to said side flaps and closing same to seal said carton for shipment.

30. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons and adapted to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, means for receiving a continuous stream of articles at said article inlet and for conveying same in a given sense to a grouping station, means at said grouping station for separating said articles into groups adapted to fill said cartons while said articles continue to move generally in said given sense, and means for conveying the thus grouped articles to said packing station under said carton conveying means while said articles continue to move generally in said given sense, means operatively drivingly connecting said carton conveying means to said article grouping means, whereby a group of articles is aligned at said packing station with a carton as it reaches said packing station, and means at said packing station, operatively connected to said carton conveying means for lowering a carton over a group of articles as it reaches said packing station.

31. An automatic casing machine adapted to receive at a carton inlet a continuous stream of cartons and adapted to receive at an article inlet a continuous stream of articles and further adapted to pack said articles in said cartons at a packing station, means for receiving a continuous stream of articles at said article inlet and for conveying same to a grouping station, means at said grouping station for separating said articles into groups adapted to fill said cartons, and for conveying the thus grouped articles to said packing station under said carton conveying means, means operatively drivingly connecting said carton conveying means to said article grouping means, whereby a group of articles is aligned at said packing station with a carton as it reaches said packing station, and means at said packing station, operatively connected to said carton conveying means for lowering a carton over a group of articles as it reaches said packing station, wherein said cartons are conveyed to said packing station above said group of articles on support means, aperture means in said support means of a size and shape adapted to receive said cartons therethrough, yieldable holding means adapted to hold said carton above said aperture means and to yield upon forceful pushing of said carton downwardly, said carton lowering means comprising carton pushdown means adapted to engage said carton and push it downwardly through said opening with sufficient force to cause said holding means to yield.

32. The apparatus of claim 31, wherein said pushdown means comprises rotary means having a pushing element adapted to engage a carton at a given point in its rotary path during each complete rotation of said rotary means, said rotary means being operatively drivingly connected to said carton conveying means whereby a carton is aligned over said aperture each time said pushing element reaches said given point.

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