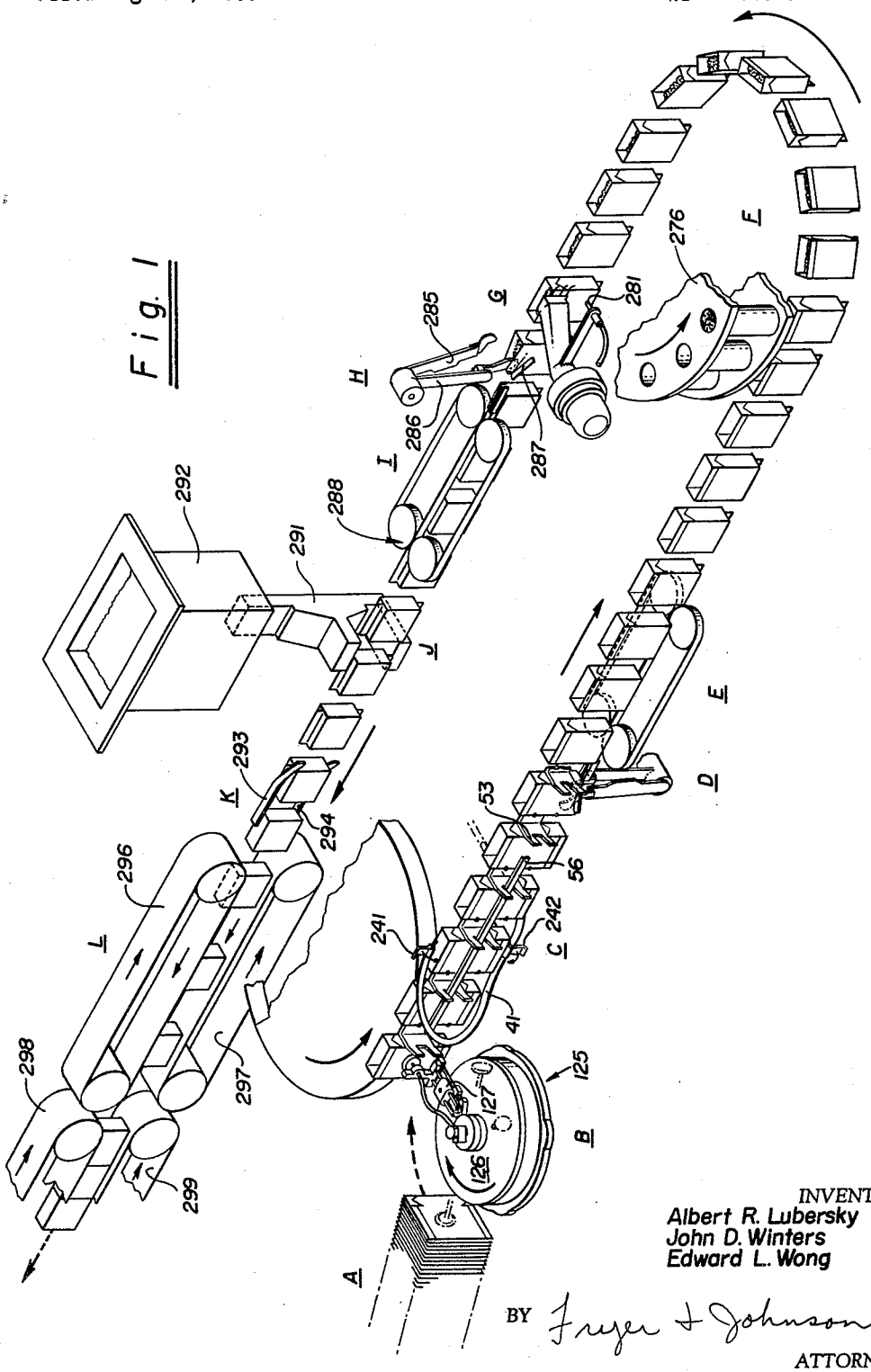
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CARTON SETTING-UP MACHINE AND METHOD

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Fig. 1



INVENTORS
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CARTON SETTING-UP MACHINE AND METHOD

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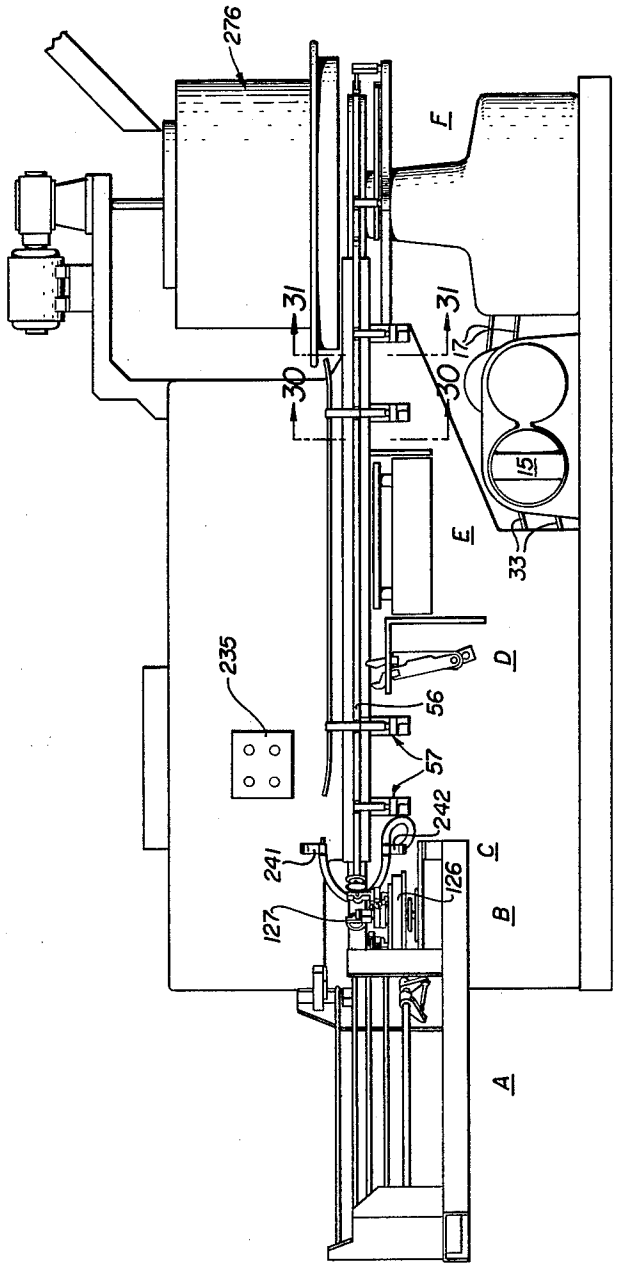


Fig. 2

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CARTON SETTING-UP MACHINE AND METHOD

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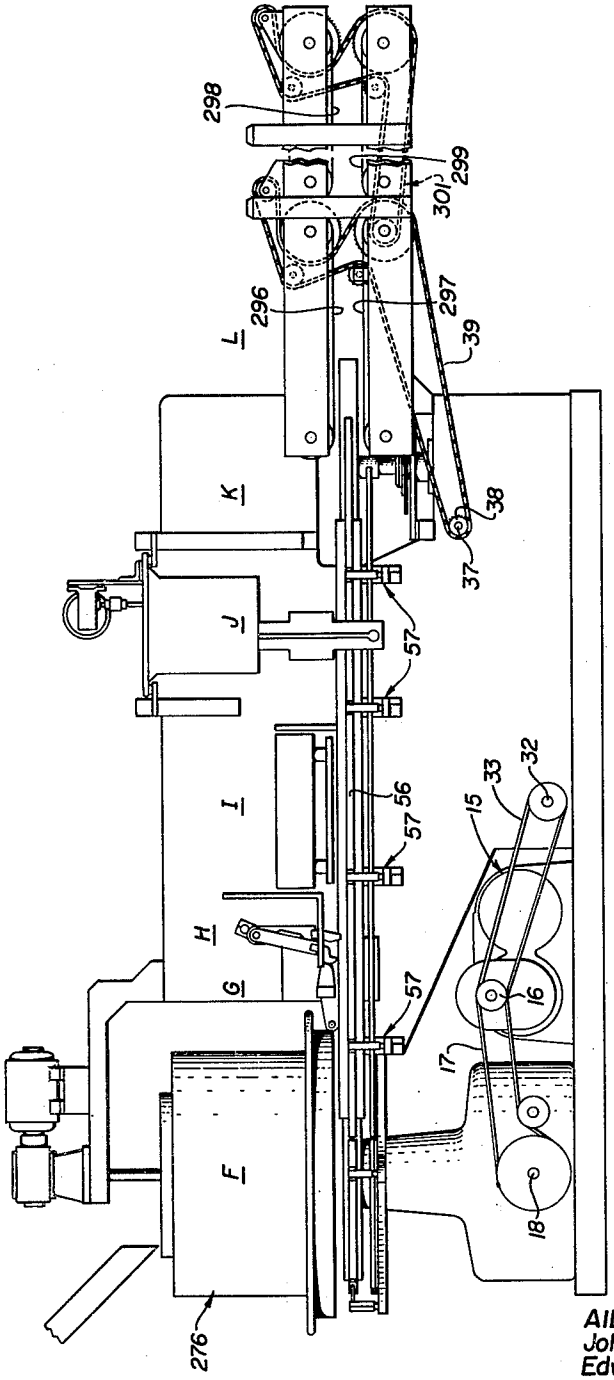


Fig. 3

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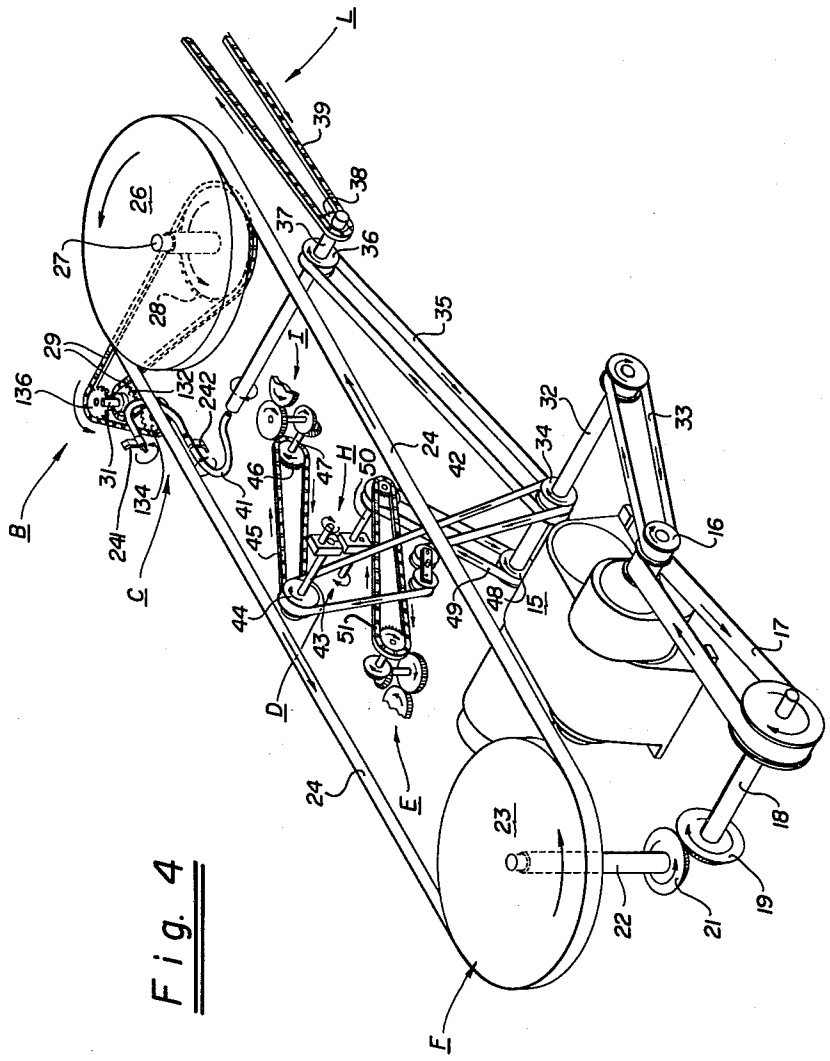


Fig. 4

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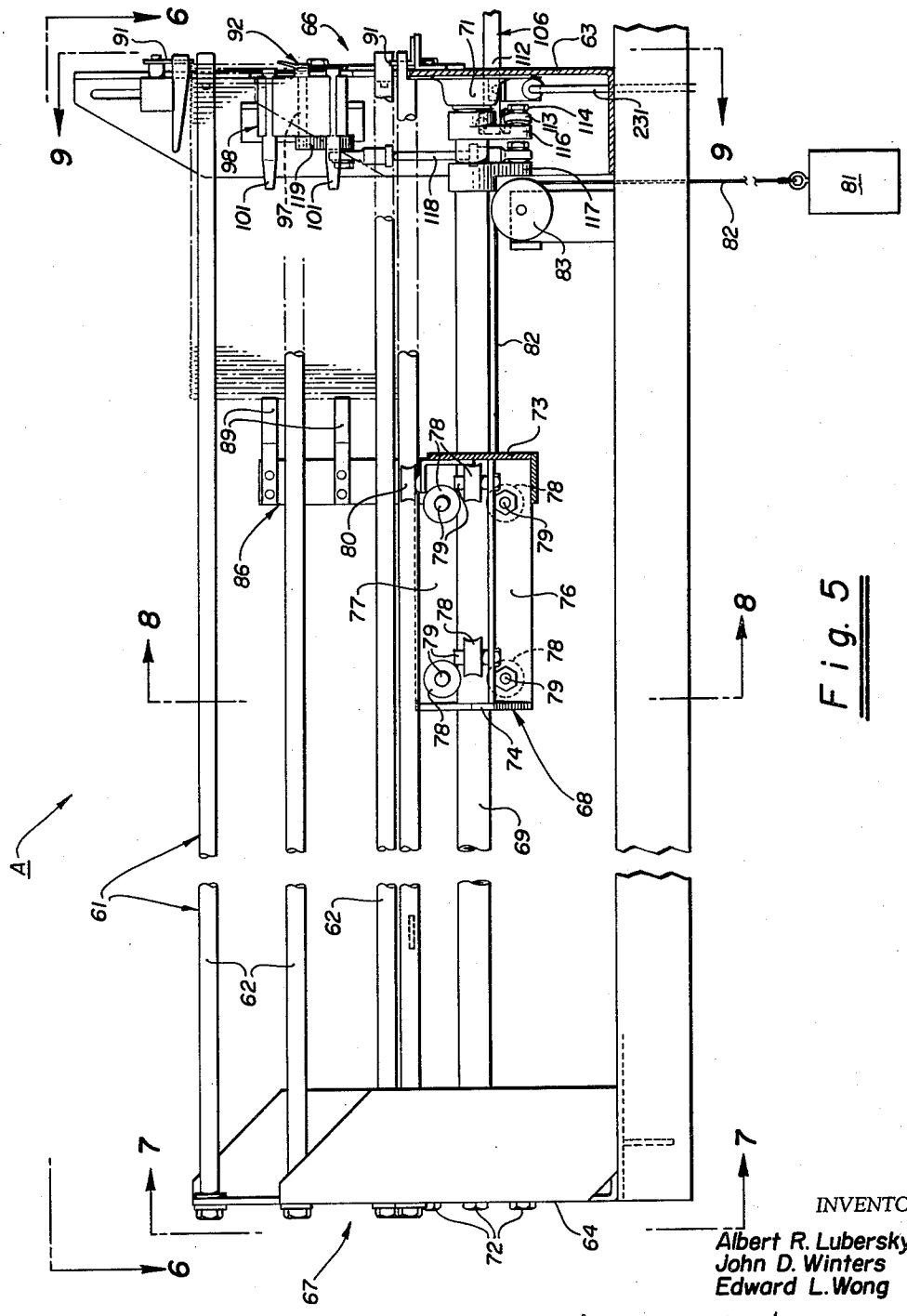


Fig. 5

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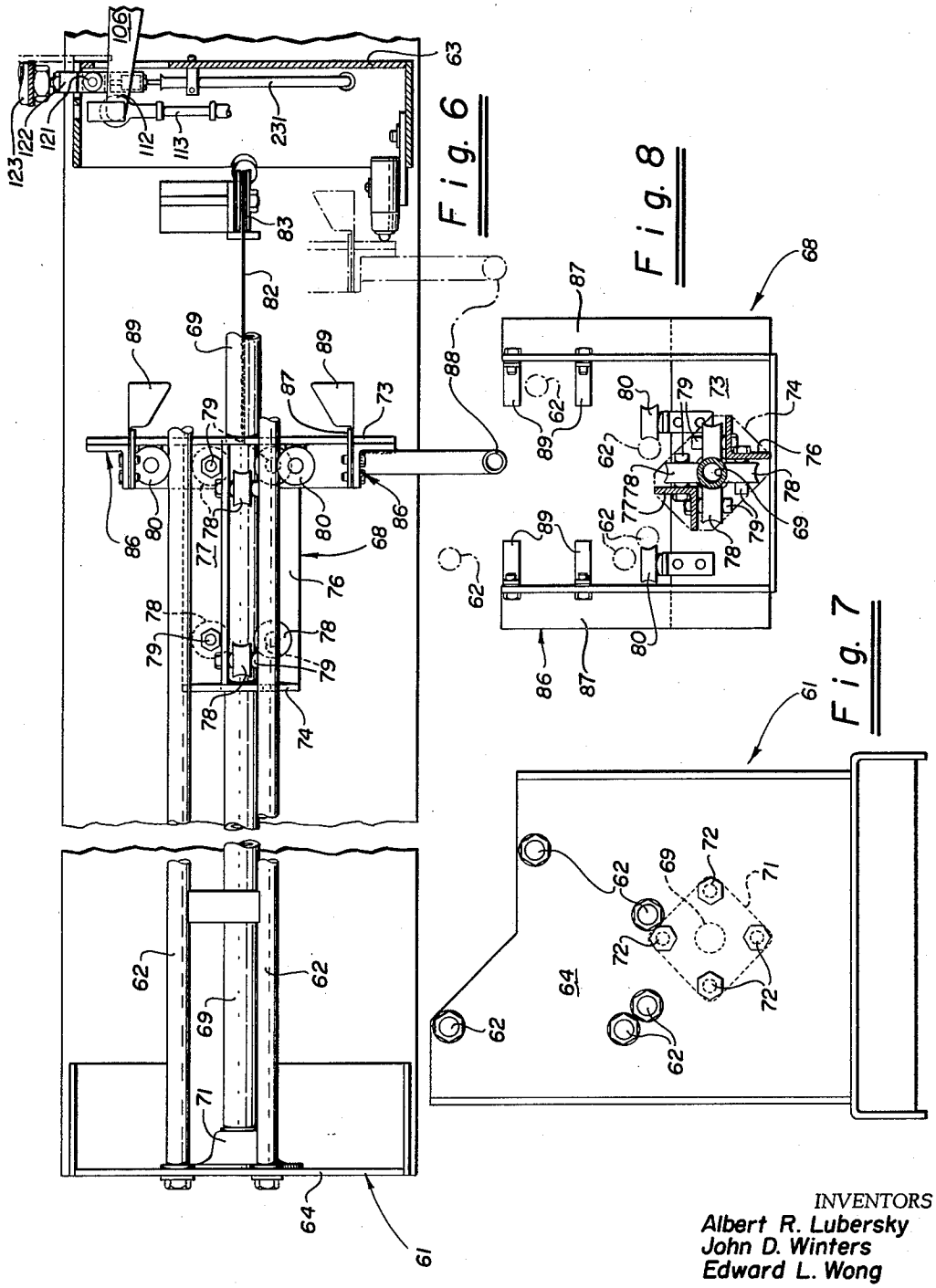


Fig. 6

Fig. 8

Fig. 7

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CARTON SETTING-UP MACHINE AND METHOD

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Fig. 10

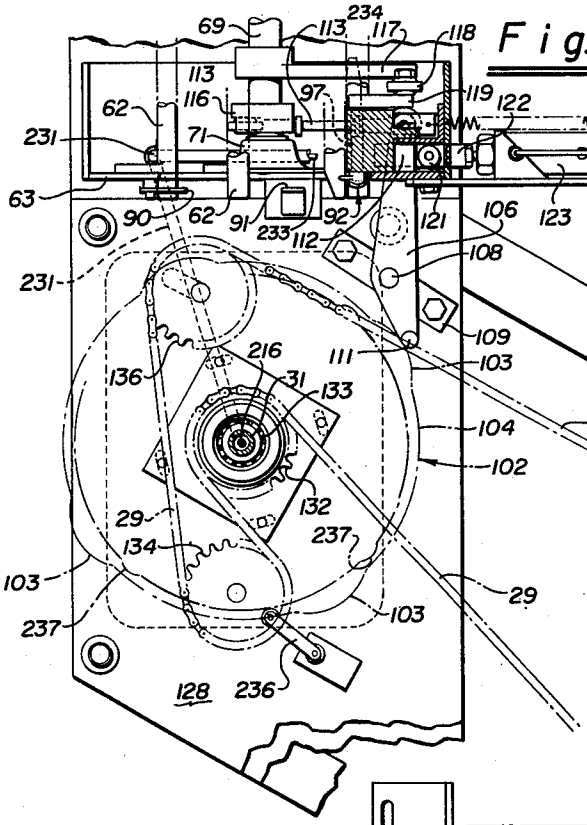


Fig. IIc

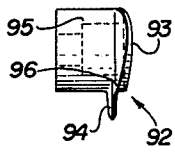
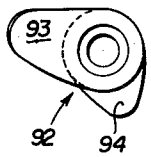


Fig. IId



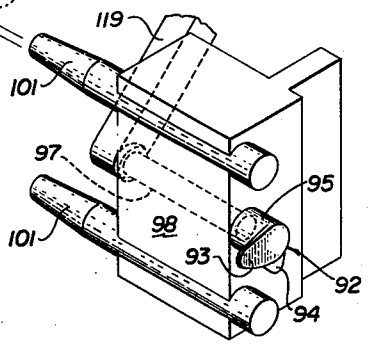


Fig. IIe

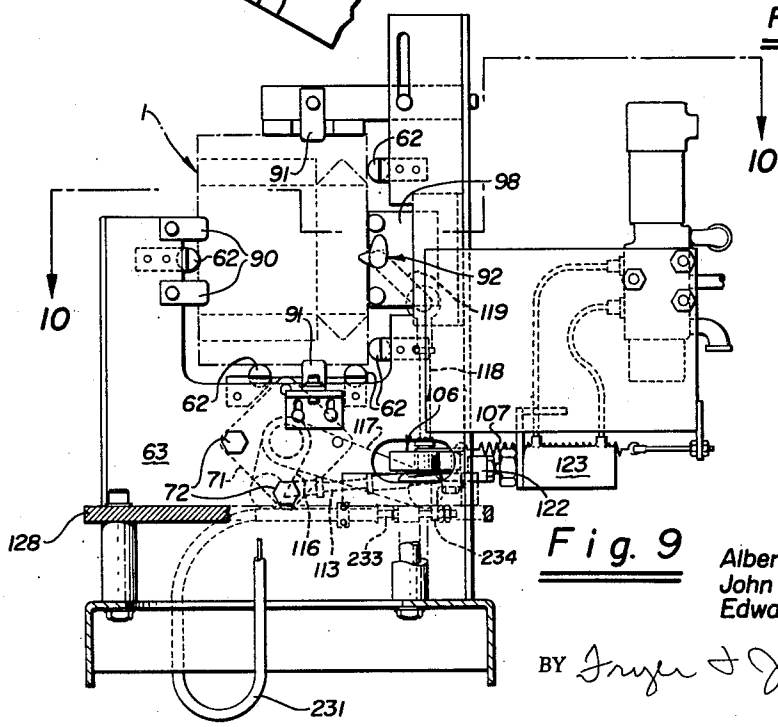


Fig. 9

INVENTORS
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CARTON SETTING-UP MACHINE AND METHOD

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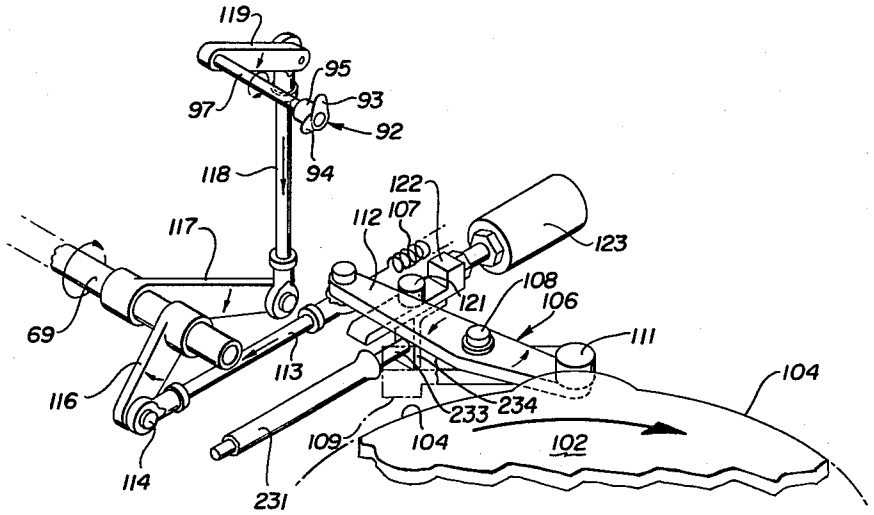


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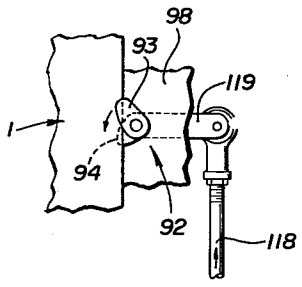


Fig. 11a

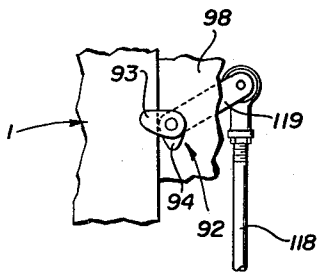


Fig. 11b

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CARTON SETTING-UP MACHINE AND METHOD

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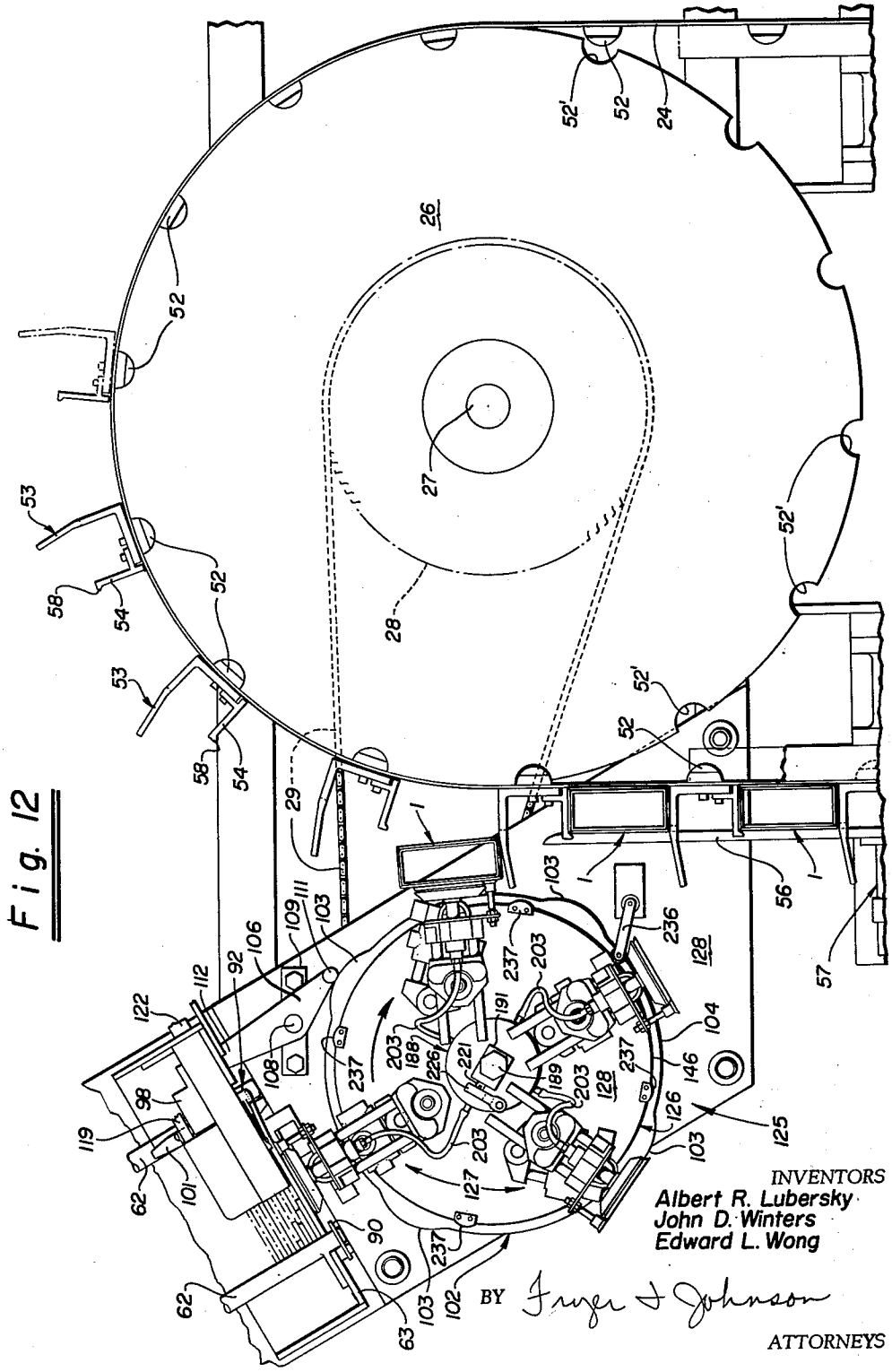


Fig. 12

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CARTON SETTING-UP MACHINE AND METHOD

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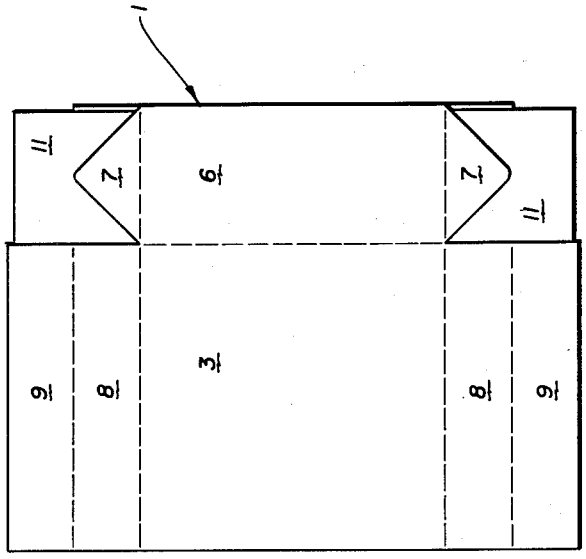


Fig. 13b

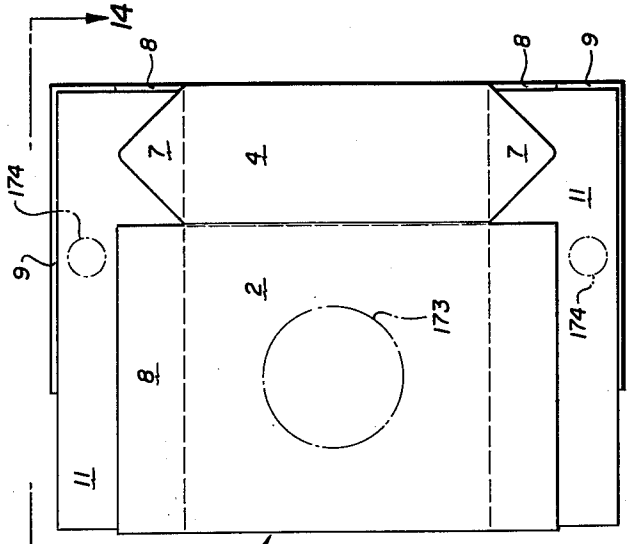
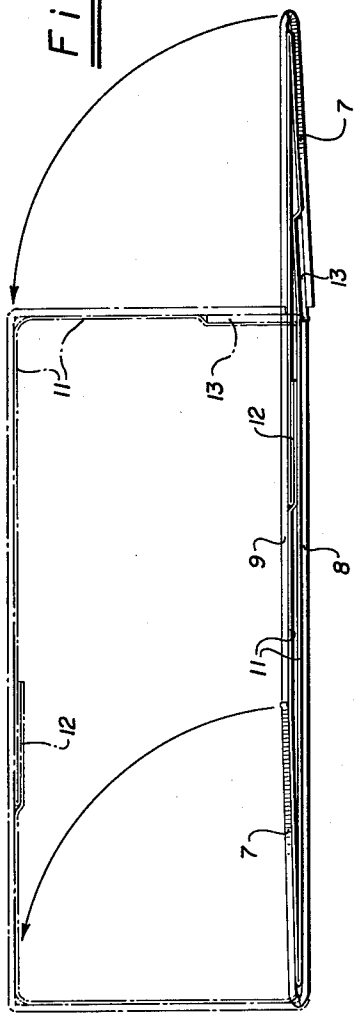


Fig. 13a

Fig. 14



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CARTON SETTING-UP MACHINE AND METHOD

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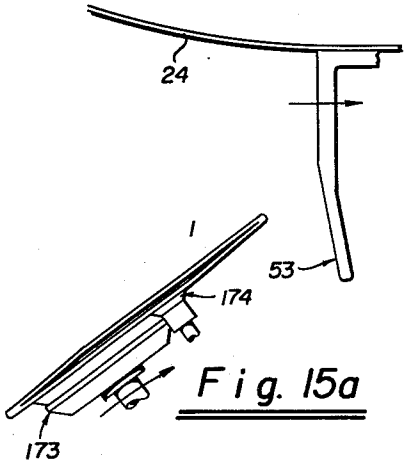


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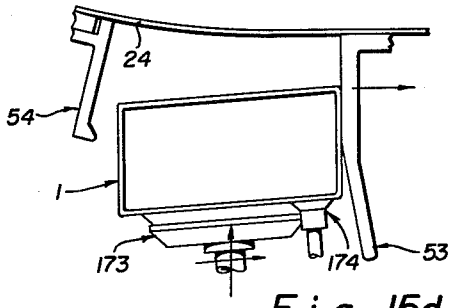


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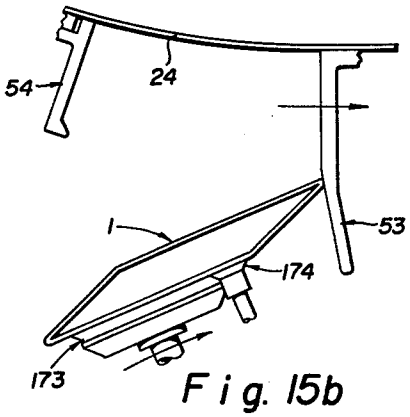


Fig. 15b

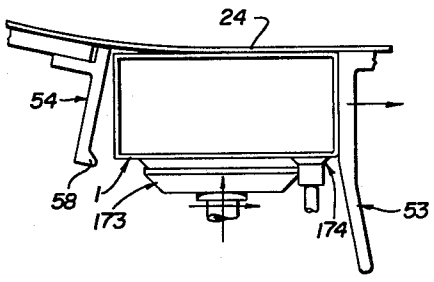


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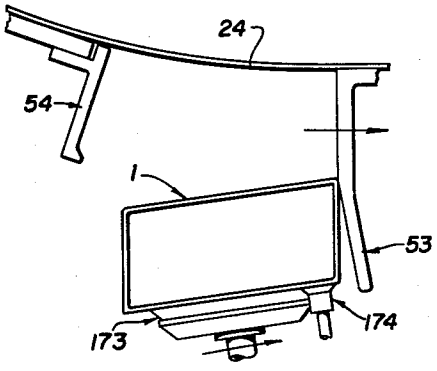


Fig. 15c

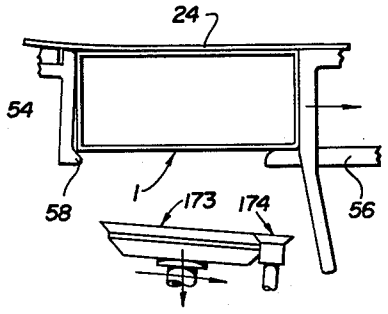


Fig. 15f

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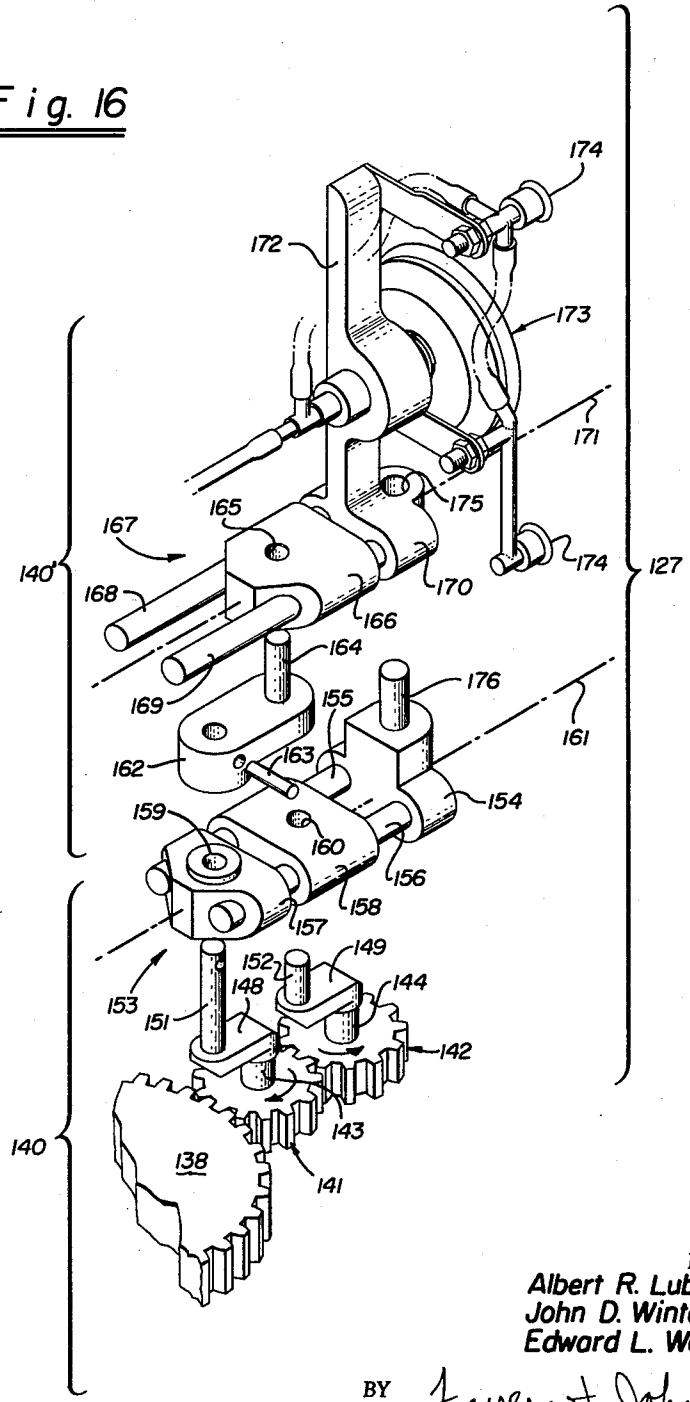
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CARTON SETTING-UP MACHINE AND METHOD

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Fig. 16



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CARTON SETTING-UP MACHINE AND METHOD

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Fig. 17

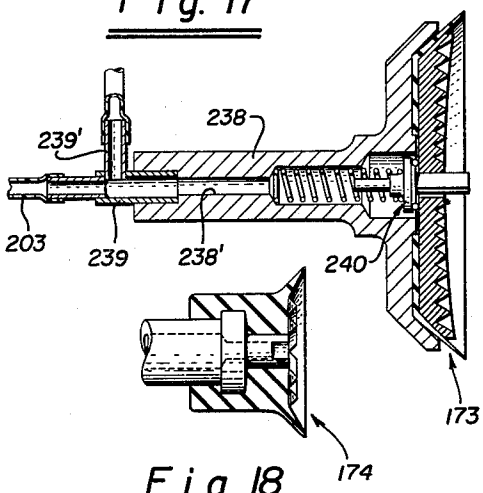
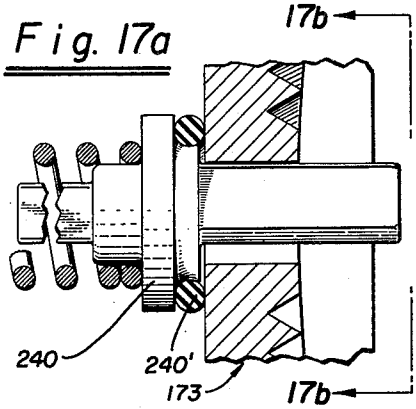


Fig. 18

Fig. 17a



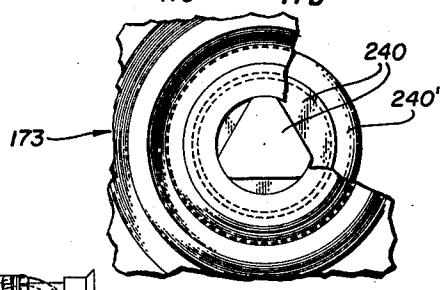


Fig. 17b

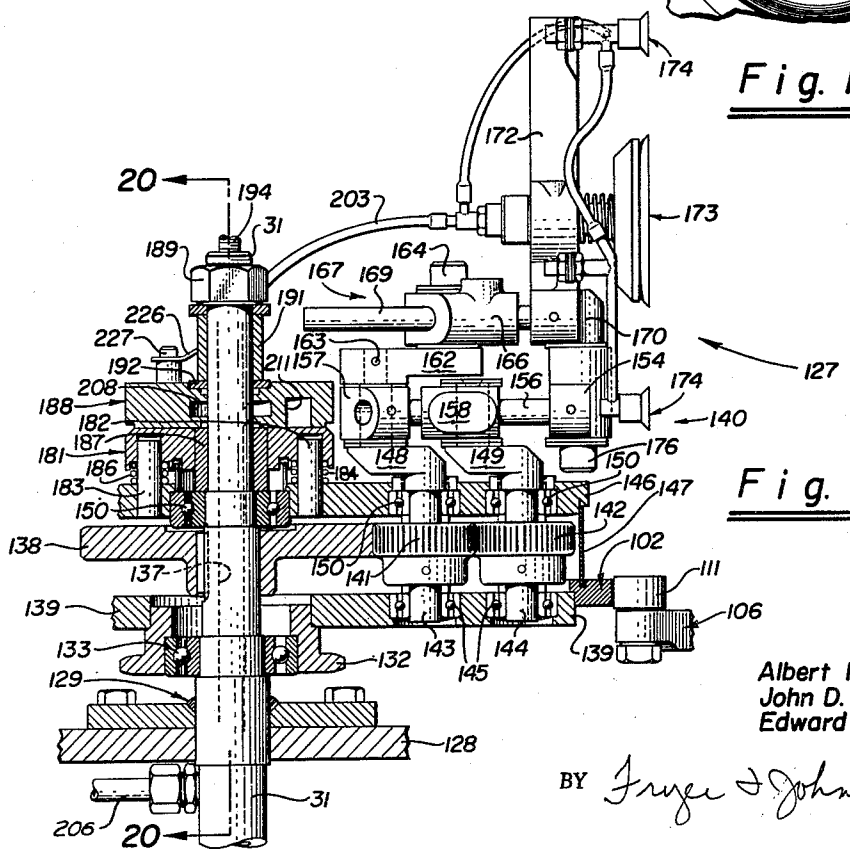


Fig. 16a

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CARTON SETTING-UP MACHINE AND METHOD

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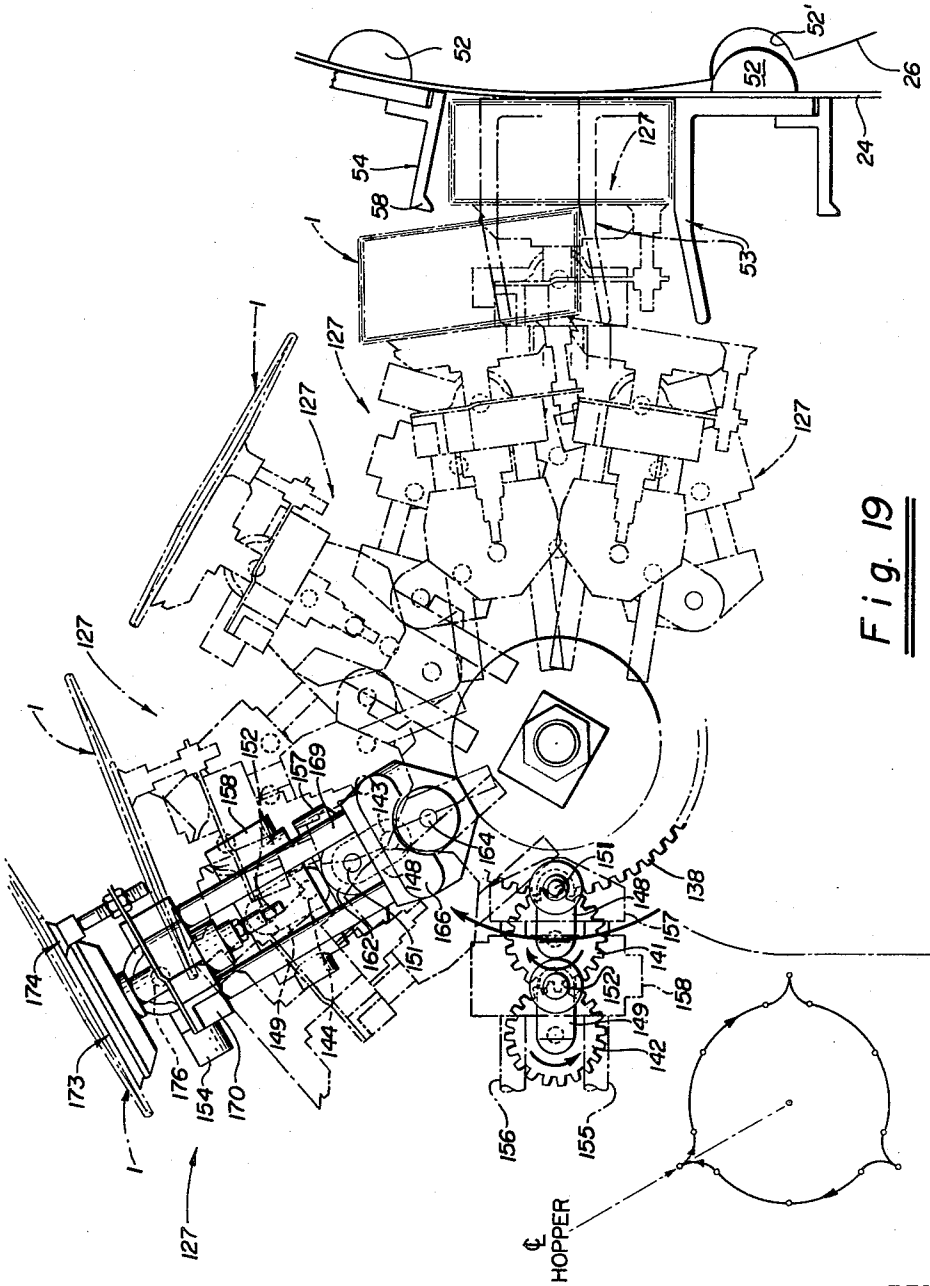


Fig. 19

Fig. 19a

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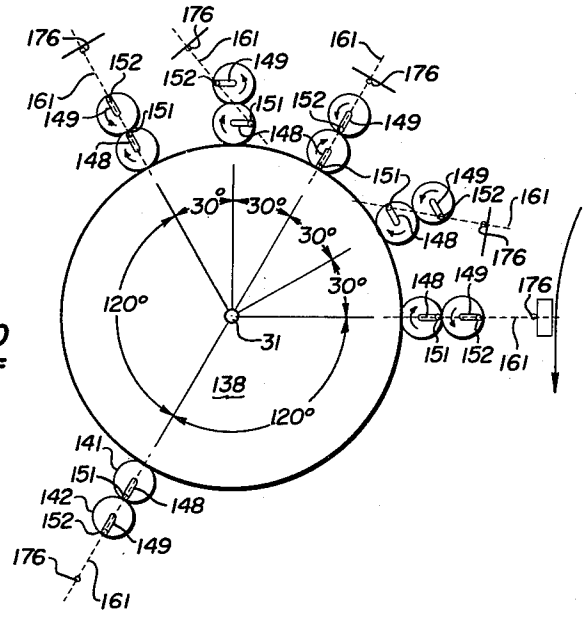


Fig. 19b

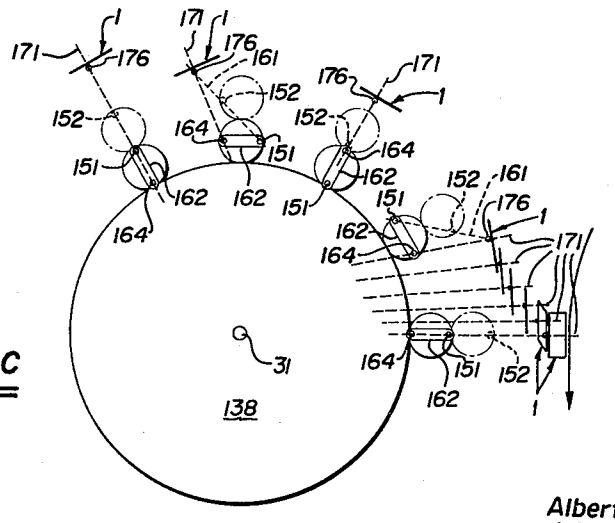


Fig. 19c

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CARTON SETTING-UP MACHINE AND METHOD

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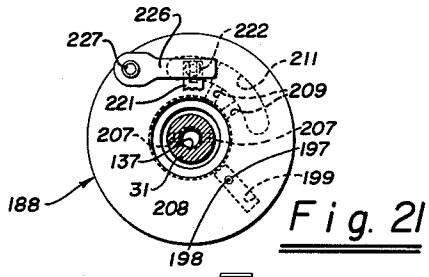


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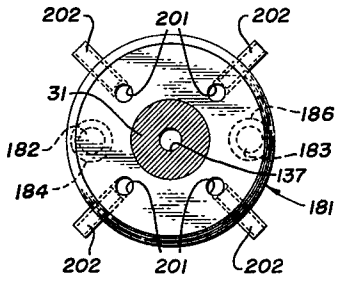


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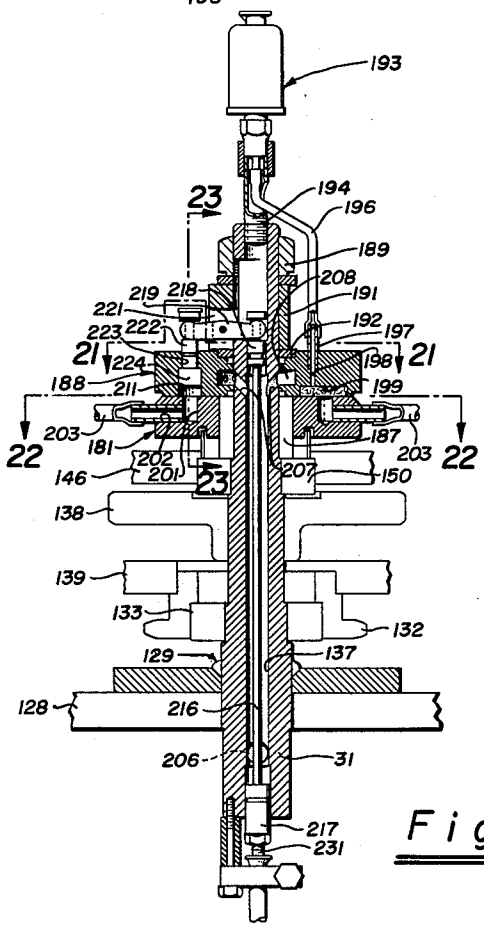


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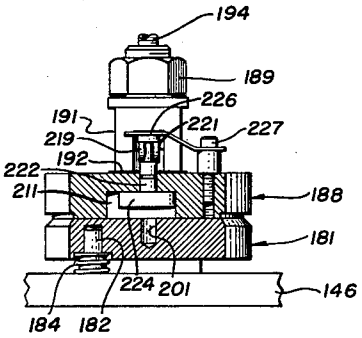


Fig. 23

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CARTON SETTING-UP MACHINE AND METHOD

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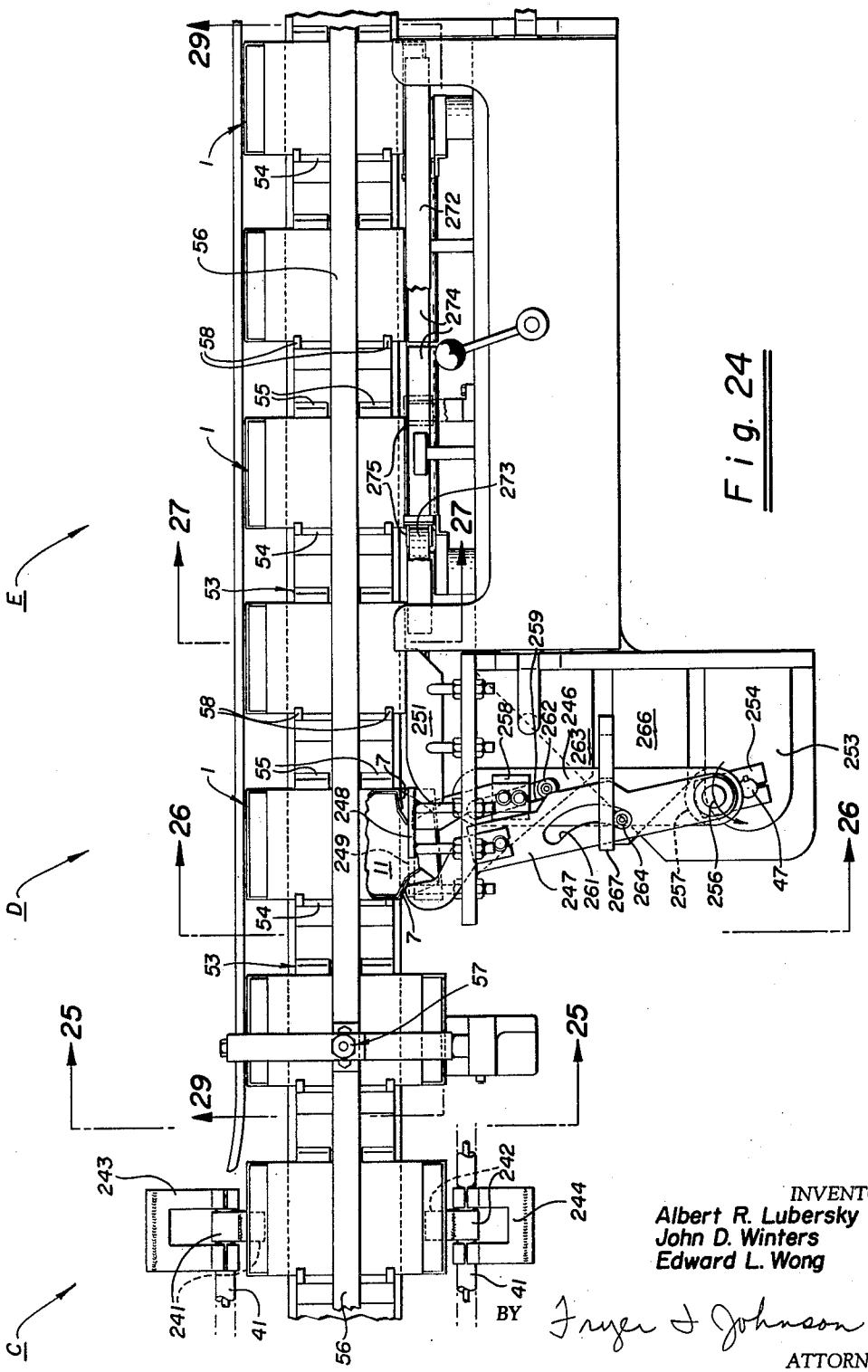


Fig. 24

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CARTON SETTING-UP MACHINE AND METHOD

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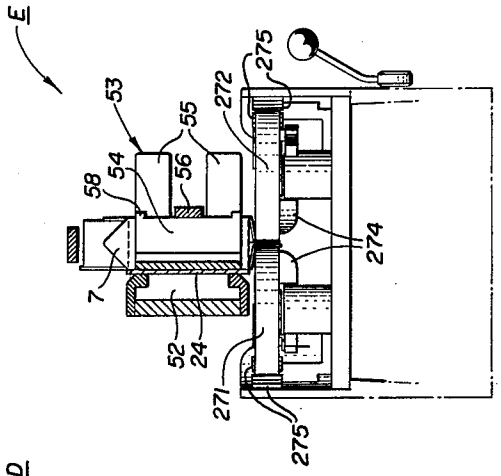


Fig. 27

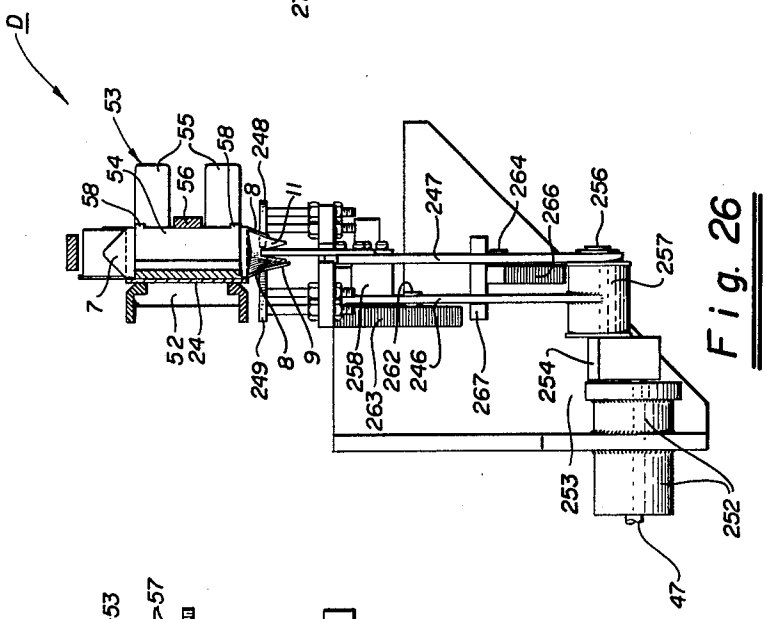


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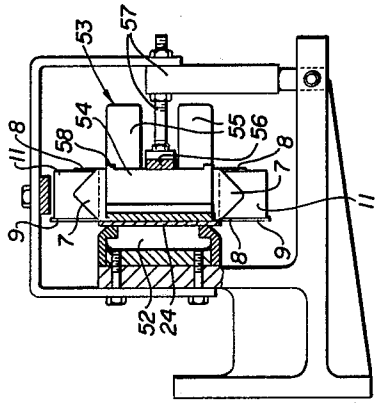


Fig. 25

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CARTON SETTING-UP MACHINE AND METHOD

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Fig. 28a

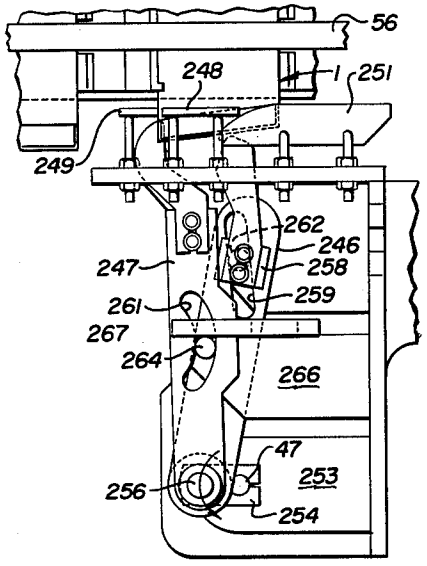
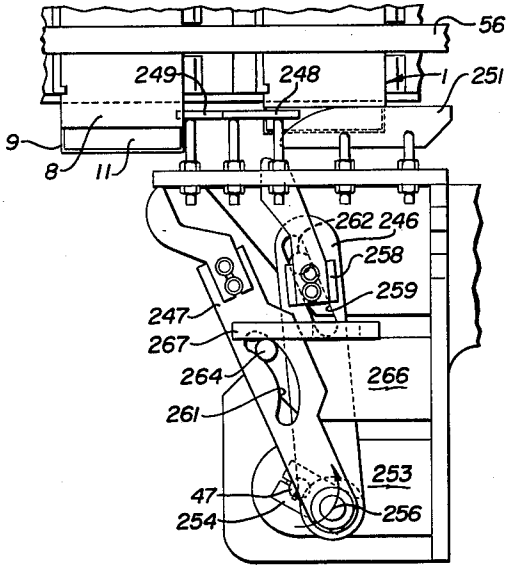


Fig. 28c



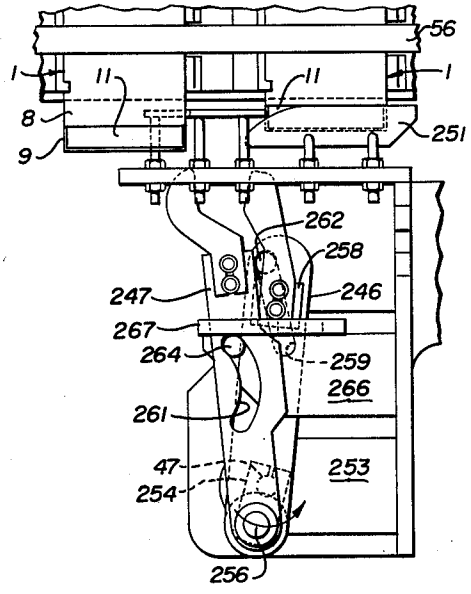


Fig. 28b

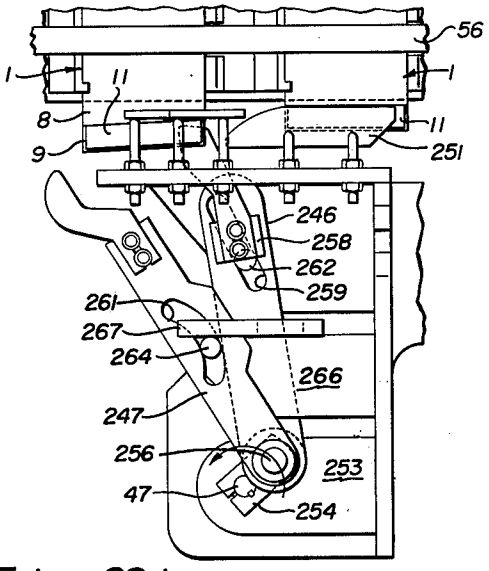


Fig. 28d

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CARTON SETTING-UP MACHINE AND METHOD

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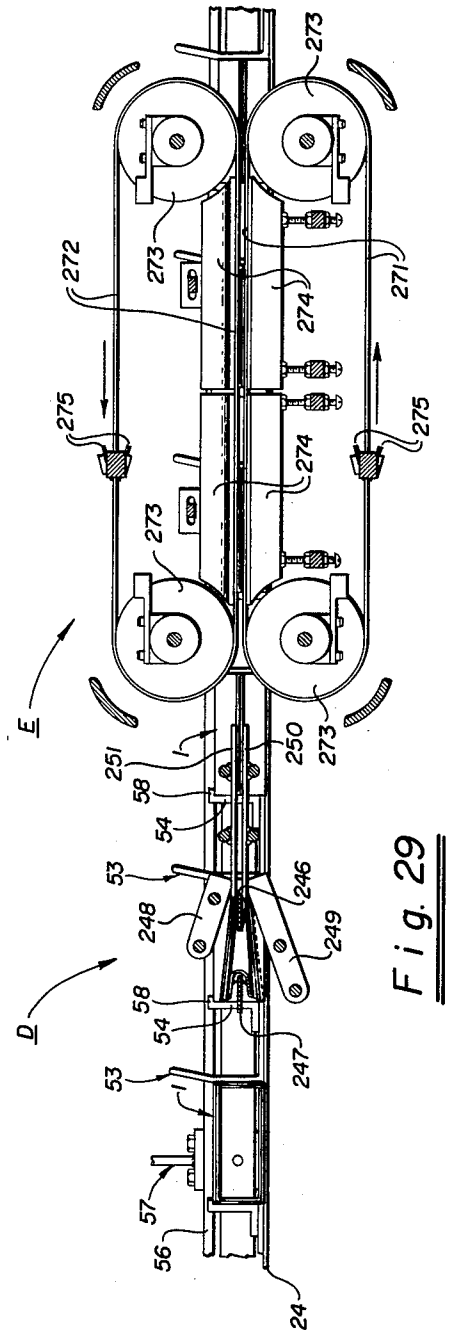


Fig. 29

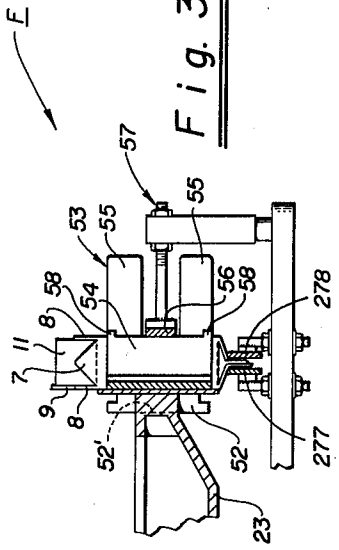


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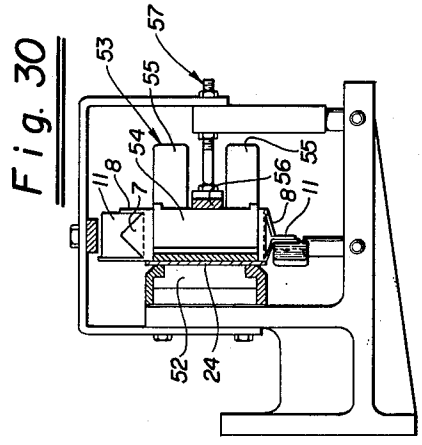


Fig. 30

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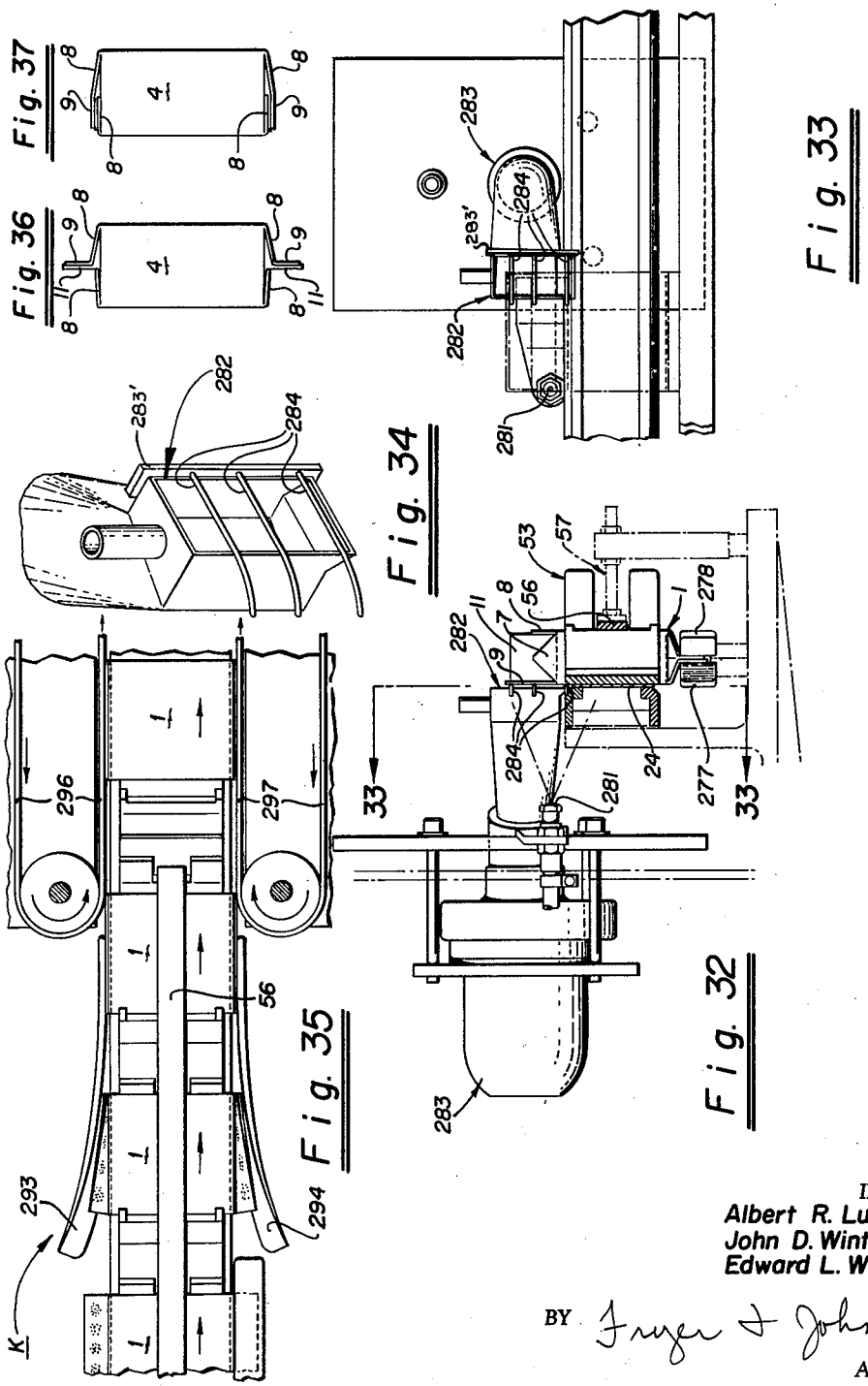
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CARTON SETTING-UP MACHINE AND METHOD

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This invention relates generally to a handling system for rapidly transforming cartons of paperboard or like flexible material from the collapsed state to the eretced state and for filling the cartons with a desired product and completely sealing the same. More particularly, the invention involves a carton setting-up machine and method in which frozen food and like cartons which have been preformed into a collapsed tubular condition are withdrawn individually and sequentially from a supply of cartons and are subjected to a series of operations which effect transforming each of the cartons to the open tubular condition, closing and sealing one end of each of the cartons, filling each of the cartons with a desired product, closing and sealing the other end of each of the cartons, and discharging the filled and sealed cartons, all of which operations are performed sequentially with the cartons moving continuously and in an uninterrupted manner.

While the invention relates to an overall machine and method for setting up and filling cartons, the same also relates to various sub-assemblies of the machine, including a rotating carton transfer mechanism which is cooperable with a particular conveyor pocket construction in effecting transformation of cartons to the erected state; as well as to means for effecting separation of individual cartons from a supply of cartons, for insuring opposite ends of an erected carton are fully open and unrestricted, and for closing and sealing the opposite carton ends.

Accordingly, objects of this invention include the provision of a carton erecting and filling method and machine which employs a continuously rotating carton transfer mechanism which engages a carton supply in a direction generally normal to the plane of the cartons and without wiping thereacross to effect sure transfer of cartons from the supply to a conveyor of the machine; means for separating individual cartons from a supply so that the same may be grasped by the transfer mechanism; means for securely positioning cartons on the conveyor during the filling and sealing operations; means for closing the respective carton ends before sealing thereof; and integrated drive means whereby all the sub-assemblies of the machine may be driven in timed relationship with each other. These and other objects will become apparent from a study of the following specification.

Summarizing the machine construction before discussing in a detailed manner the machine and its various sub-assemblies and components, the same includes a carton supply hopper in which a plurality of cartons in the collapsed tubular condition are positioned and from which cartons are individually withdrawn by a rotating turret vacuum type transfer mechanism positioned adjacent the discharge end thereof. Such withdrawal is accomplished without the transfer mechanism wiping across the cartons. Oscillating means in the form of a reciprocating flag device desirably is positioned on the hopper at its discharge end for normally retaining the supply of cartons in the hopper and for periodically separating the outermost carton therefrom in timed relationship with operation of the transfer mechanism.

Upon withdrawal of an outermost carton from the hopper in a direction corresponding generally to the center line of the hopper, that is, generally normal to the plane of the collapsed carton, the same is transferred in a

generally circular direction into engagement with a receiving pocket on a continuously moving conveyor. Upon engagement of the carton with the conveyor, transformation thereof to the erected state is effected.

Each of such conveyor pockets is constructed in such a manner that the same cooperates with the transfer mechanism in transforming the originally collapsed tubular cartons to the open tubular condition. The erected cartons are carried by the conveyor past a station where a rotating carton engaging device is positioned for insuring that opposite ends of the cartons are open and unrestricted, following which the cartons are carried past movable end closure means which engage the open bottom ends of the respective cartons and fold the same inwardly to effect closing thereof. Following such closing, the cartons are carried through a sealing device in which such bottom ends are rendered fluid tight.

Thereafter, the cartons are carried past a filler from which a measured quantity of product is metered into each carton. Subsequently, the filled cartons are transferred past a cleaning mechanism, following which the upper ends thereof are closed and sealed in a manner similar to closing and sealing of the bottom ends. The opposite extremities at the sealed ends of the cartons are then folded down and adhesively secured to the carton ends to impart each carton with a compact configuration suitable for overwrapping or the like. Finally, the filled cartons are discharged from the machine and may then be transferred to suitable overwrap, freezing or other type equipment.

Specific details of the sub-assemblies and other various novel features of the subject machine will be discussed hereinafter. In such discussion, reference will be directed to the accompanying drawings, in which:

FIG. 1 is a schematic illustration of the overall machine illustrating the flow of cartons through the machine and showing the operations performed thereon at various stations;

FIG. 2 is a side elevation of one side of the machine;

FIG. 3 is a side elevation of the opposite side of the machine;

FIG. 4 is a schmatic pespective view of the integrated drive mechanism of the machine;

FIG. 5 is a side elevation of the supply hopper;

FIG. 6 is a plan view of the supply hopper taken in the plane of line **6—6** of FIG. 5;

FIG. 7 is an end elevation of the supply hopper taken in the plane of line **7—7** of FIG. 5;

FIG. 8 is a vertical section of the supply hopper taken in the plane of line **8—8** of FIG. 5;

FIG. 9 is an end elevation of the discharge end of the supply hopper taken in the plane of line **9—9** of FIG. 5;

FIG. 10 is a partial horizontal section of the discharge end of the supply hopper taken in the plane of line **10—10** of FIG. 9;

FIG. 11 is a schematic view of the linkage arrangement employed to oscillate the carton separating device;

FIGS. 11*a* to 11*e* illustrate details and mode of operation of the carton separating device;

FIG. 12 is a plan view of the feed end of the overall machine;

FIGS. 13*a* and 13*b* are plan views of opposite sides of a collapsed carton of the type well suited to be set up by the subject machine;

FIG. 14 is an end view of the carton taken in the plane of line **14—14** of FIG. 13*a* and showing, in phantom lines, the manner in which such a carton is transformed to the erected tubular condition;

FIGS. 15*a* to 15*f* illustrate in sequence form the co-

operation involved between the transfer mechanism and a conveyor pocket in erecting a carton;

FIG. 16 is an isometric exploded view on an enlarged scale of a suction head of the transfer mechanism;

FIG. 16*a* is a partial vertical section of an assembled suction head of the type shown in FIG. 16;

FIGS. 17 to 17*b* illustrate details of a major suction cup construction usable with the transfer mechanism;

FIG. 18 is a sectional view of a minor suction cup usable with the transfer mechanism;

FIG. 19 is a schematic view illustrating in sequence form the general path followed by a carton during pick up, transfer and erection of the same;

FIG. 19*a* is a schematic view illustrating generally the path of travel of a suction cup on a suction head during one revolution of the transfer mechanism;

FIGS. 19*b* and 19*c* are schematic views illustrating relative positions of components of a suction head during movement thereof;

FIG. 20 is a vertical section of the vacuum control arrangement of the transfer mechanism taken in the plane of line **20—20** of FIG. 16*a*;

FIG. 21 is a horizontal section of the vacuum control arrangement taken in the plane of line **21—21** of FIG. 20;

FIG. 22 is a horizontal section of the vacuum control arrangement taken in the plane of line **22—22** of FIG. 20;

FIG. 23 is a vertical section through a portion of the vacuum control arrangement taken in the plane of line **23—23** of FIG. 20;

FIG. 24 is a side elevation of a portion of the machine illustrating details of the flipper arm mechanism for insuring the carton blank ends are fully opened and the closing and sealing mechanism for the carton bottoms;

FIG. 25 is a vertical section of the carton conveyor taken in the plane of line **25—25** of FIG. 24;

FIG. 26 is a vertical section illustrating details of the carton end closing mechanism taken in the plane of line **26—26** of FIG. 24;

FIG. 27 is a vertical section illustrating details of the carton sealing mechanism taken in the plane of line **27—27** of FIG. 24;

FIGS. 28*a* to 28*d* are side elevations of the carton end closing mechanism illustrating in sequence form closing of a carton bottom end;

FIG. 29 is a horizontal section illustrating details of the carton end closing and mechanism of the machine taken in the plane of line **29—29** of FIG. 24;

FIG. 30 is a vertical section through the conveyor taken in the plane of line **30—30** of FIG. 2;

FIG. 31 is another vertical section through the conveyor taken in the plane of line **31—31** of FIG. 2;

FIG. 32 is an end elevation of the cleaning mechanism of the machine which is intended to remove any product spilled on the cartons during filling;

FIG. 33 is a front elevation of the cleaning mechanism taken in the plane of line **33—33** of FIG. 32;

FIG. 34 is an isometric view of the suction head of the cleaning mechanism on an enlarged scale relative to FIGS. 32 and 33;

FIG. 35 is a side elevation of the discharge end of the machine showing details of the mechanism for folding the projecting extremities at opposite sealed ends of the carton after filling;

FIG. 36 is a side elevation of a closed carton before folding of the sealed end extremities thereof;

FIG. 37 is a side elevation of a closed carton after folding of the sealed end extremities thereof.

The Carton

While the subject machine may be employed for filling and sealing cartons of various constructions, the same is particularly well adapted for sealing cartons of the

type shown in FIGS. 13*a*, 13*b* and 14. The illustrated carton is the subject of the invention disclosed in copending application Serial No. 661,845, filed May 27, 1957, which is assigned by its inventors to the assignee of this invention.

Such carton **1** is formed from a flat paperboard or like flexible blank into a collapsed tubular carton defined by opposite rectangular side walls **2** and **3** and opposite rectangular end walls **4** and **6** which are of the same length but of less width than side walls **2** and **3**. Extending from and hingedly connected to each of opposite upper and lower ends of each of the ends walls **4** and **6** is a triangular cover tab **7**. Each collapsed carton **1** also includes a cover flap **8** hingedly connected to and extending from opposite top and bottom ends of each of the side walls **2** and **3**. To each of the cover flaps **8** hingedly connected to side wall **3** is hingedly connected a ridge flap **9**. Such ridge flaps, when the carton ends are unsealed, extend straight and unfolded beyond the respective cover flaps to which they are connected.

Adhesively secured within the collapsed carton is a collapsed tubular carton liner **11**, at least the inner surface of which is composed of a heat sealable material, such as polyethylene or the like. Liner **11** may be of one piece extruded constructed or may be formed from a flat laminated sheet which is folded upon itself and adhesively secured to form a seam **12** as shown in FIG. 14 thereby imparting the tubular configuration thereto. Desirably opposite ends of the carton liner terminate substantially flush with but do not extend beyond the extremities of ridge flaps **9** whereby the liner is protected by the ridge flaps durig shipment and storage. As shown in FIG. 14 the carton blank is formed into tubular configuration by adhesively securing end wall **4** to a glue flap **13** extending from side wall **2**.

The carton liner **11** is spot adhesively secured to the inner surfaces of the walls of the carton as well as to the cover tabs **7**, cover flaps **8** and ridge flaps **9**. As a result, when opening pressure is applied to an edge of the carton as will be described, the carton and liner are transformed to the open tubular configuration shown in phantom lines in FIG. 14. Although a carton of this type is highly desirable for use with the present machine, other cartons also may be employed therewith without departing from the scope of the present invention.

Because of the heat sealing character of the liner of the carton disclosed herein, such carton is rendered fluid tight after sealing and is particularly well adapted for packaging particulate and liquiform food to be frozen, such as strawberries, beans, peas and the like, as well as fruit juices and other liquids. Also, the carton may be employed for packaging non-edibles such as lotions, motor oils and the like.

Summary of the Carton Setting-Up and Filling Operation

Referring to the carton flow sheet of FIG. 1, the entire carton setting-up and filling operation will be briefly described before the details of the particular machine subassemblies are set out. The machine comprises a series of separate stations from or past which the cartons are moved without interruption and at which particular operations are performed on the respective cartons. A compact machine is provided by changing direction of carton flow at the filler station so that the cartons are carried through the machine in two generally parallel lines.

A carton supply hopper in which a plurality of collapsed cartons are retained is positioned at station A. Such hopper includes an oscilalting carton separating device to be described hereinafter. A rotary carton transfer mechanism is provided at station B and is interposed between the discharge end of the hopper and a continuously moving conveyor. The transfer mechanism comprises a series of suction heads each of which is intended to sequentially engage and pick up the outermost carton in the hopper and transfer the same in an uninterrupted

motion to a pocket provided on the continuously moving conveyor. Because of the particular construction of each of the conveyor pockets and the manner in which each suction head is moved relative thereto, a suction head is cooperable with a pocket to effect rapid and automatic transformation of a carton to the fully open tubular condition as the same is inserted into a pocket.

The conveyor is arranged to move in a horizontal path and carries the respective cartons, after their release from the respective suction heads, past a flipper arm mechanism at station C which comprises a pair of continously rotatable flipper arms each of which is insertable into an end of each carton carried therepast to insure that the opposite carton ends are fully open and unrestricted.

Thereafter, the conveyor carries the cartons past a carton bottom end closing mechanism at station D which comprises a pair of tucker arms movable rapidly and periodically in reciprocating fashion into engagement with the triangular cover tabs at the bottom end of each carton for effecting inward folding of such cover tabs and the carton liner therewith to provide gusset type folds in the respective carton bottom ends. A suitable plow device also is provided at station D for cooperating in substantially simultaneous fashion with the tucker arms for inwardly folding and completely closing the carton bottom ends. At station E, a suitable heat sealing device is provided which applies heat and pressure to the closed carton bottom extremities and causes the gusset folded ends of the liners to be completely heat sealed and rendered fluid tight.

Thereafter, the cartons are carried by the conveyor to station F at which a suitable rotary filling device is positioned which discharges a predetermined quantity of product into each of the cartons without requiring stopping of the cartons during their travel therebeneath. Because the subject conveyor is capable of high speed movement which might result in minor spilling or overflow of product onto the outer walls of the carton, carton cleaning mechanism is provided at station G for removing any such spillage. Such mechanism comprises a water spray and vacuum arrangement which first washes off any spillage from the cartons and thereafter removes any excess water or remaining spillage.

Following such a cleaning operation, the cartons are transported to another end closing mechanism comprising another pair of tucker arms and plow device mounted at station H. These tucker arms and plow device are of the same construction as those mounted at station D but are mounted in the inverted position to close the upper end of the cartons. Another heat sealer mounted in inverted position is provided at station I for applying heat and pressure to the upper closed ends of the cartons for completely sealing the liners to retain the filled product in the cartons.

At station J a suitable applicator device is provided which applies a suitable adhesive to the upper and lower sealed ends of the filled cartons so that the extremities thereof may be retained in folded over condition. At station K, folding of the sealed upper and lower extremities by suitable plow devices is effected. Station L comprises a conveyor onto which the sealed and folded cartons are transferred. This conveyor performs the dual function of applying pressure to the cartons for maintaining the sealed ends folded over while the adhesive applied thereto hardens and of conveying the cartons away from the machine so that subsequent operations may be performed thereon if desired, such as overwrapping or freezing.

Desirably, the conveyor at station L is comprised of two sections one of which operates at a speed slower than the other so that the cartons spaced from each other during their transfer through the machine can be moved into contacting arrangement with each other.

The relative positions of the various stations also are indicated on the assembled machine shown in FIGS. 2 and 3.

From the foregoing, it should be understood that the cartons move continuously from the time they are sequentially and individually withdrawn from the supply hopper at station A until they are discharged from the machine at station L. A variable speed integrated drive is provided so that the number of cartons to be filled per unit of time can be varied as desired. As a result, the machine is operable at high speeds so that 200 or more cartons of a 16 ounce capacity may be filled and sealed per minute. If desired, the speed may be reduced to as low as 50 cartons per minute or less.

Because as noted it frequently is desirable to vary the speed at which the machine is operated, it is highly desirable that the same be provided with an integrated drive so that the various sub-assemblies and mechanisms may be driven in timed, synchronized relationship which precludes the need of adjusting the speed of any individual components of the machine when the overall machine speed is changed.

The Integrated Drive of the Machine

The integrated drive is schematically illustrated in FIG. 4. The various mechanisms and sub-assemblies of the machine are driven from a common source, such as electric motor **15** mounted on the machine base as shown in FIGS. 2 and 3 and which has a toothed drive pulley **16** connected to the drive shaft thereof. A suitable conveyor drive toothed timing belt **17** or chain or the like is connected to the pulley **16** and transfers power therefrom to a horizontal connecting shaft **18** having a bevel gear **19** on an end thereof which is cooperable with a horizontally mounted bevel gear **21** mounted on the bottom end of upright conveyor drive shaft **22**. Conveyor shaft **22** is keyed or otherwise secured to a sprocket **23** about which an endless conveyor belt **24** passes and which travels therearound upon rotation of shaft **22**. The rotary filler at station F is mounted in any suitable manner upon sprocket **23** and is rotated therewith.

Conveyor belt **24** transmits motion from rotatable sprocket **23** to another rotatable conveyor sprocket **26** mounted at the opposite end of the machine. A vertical shaft **27** is keyed or otherwise secured to sprocket **26** and depends therefrom. A toothed sprocket **28** is secured to the bottom end of shaft **27** and transmits rotary motion by means of a chain or like drive belt **29** to an upright shaft **31** which rotates the turret of the carton transfer mechanism at station B as will be described. As a result of the operative connection between the conveyor and the drive mechanism of the carton transfer mechanism, a timed relationship between conveyor movement and transfer of individual cartons from the supply hopper to the conveyor is controlled so that the machine may be operated at various speeds without requiring any changing or adjusting of the transfer mechanism. A suitable master speed control may be connected with drive motor **15** in any well known manner.

Motor **15** also drives a jack shaft **32** operatively connected to motor pulley **16** by a toothed timing belt **33**. By means of a suitable double pulley arrangement **34** mounted intermediate the ends of jack shaft **32**, various other mechanisms of the machine are driven from the common power source. A timing belt **35** operatively connects jack shaft **32** by means of pulley **36** to another horizontally mounted drive shaft **37** spaced therefrom and positioned beneath conveyor sprocket **26**. A toothed sprocket **38** is mounted on one end of drive shaft **37** and drives, by means of drive chain **39** passingg thereover, the belt conveyor to which filled and sealed cartons are discharged at station L as shown in FIG. 3.

Shaft **37** has connected to its opposite end a flexible shaft **41** which rotates in the same direction as shaft **37**. The flipper arm mechanism at station C, to be described,

is rotated upon rotation of flexible shaft **41** by connecting shaft **37**.

Another timing belt **42** is driven by the double pulley **34** on jack shaft **32** and is employable to rotate a tucker arm drive shaft **43** by passing over a pulley **44** mounted on the end thereof which effects movement of the upper tucker arms at station H. As belt **42** drives the tucker arm shaft **43**, it also produces movement of chain or like drive **45** which passes over a toothed sprocket on the end of shaft **43** and another toothed sprocket **46** on the end of a stub shaft **47** which effects movement of the gear train drive of the upper heat sealer at station I.

Jack shaft **32** also has a pulley **48** mounted on its other end which is operatively connected by timing belt **49** to another tucker arm drive shaft **50** which effects movement of the bottom tucker arms at station D. A suitable chain or like drive **51** passing over a toothed sprocket on the end of drive shaft **50** is effective to activate the gear train of the lower heat sealer at station E.

In this manner, all the operative mechanisms of the subject machine are driven from a common power source in suitable timed relationship one to the other so that setting-up, filling and sealing of individual cartons may be carried on continuously with a smooth uninterrupted motion. It should be understood, however, that modifications of this integrated drive could be effected without departing from the scope of the invention.

The Conveyor Construction

As shown in FIG. 12, taken in conjunction with previously described FIG. 4, the endless conveyor belt **24** desirably is of thin flexible metal construction and is positioned to move in a horizontal path about spaced sprockets **23** and **26**.

A series of spaced rounded drive lugs **52** of any suitable material are securely attached by bolts or the like to the inner surface of conveyor belt **24**. Lugs **52** are cooperatble with and receivable in arcuate recesses **52'** provided at regular intervals about the periphery of conveyor sprocket **26**. It should be understood that conveyor drive sprocket **23** also has drive recesses **52'** provided about its periphery. In this manner, conveyor belt **24** is capable of transmitting rotary motion to sprocket **26** from sprocket **23** which is operatively connected to the power source **15**.

Suitably connected in regular spaced relationship along the outer face of the conveyor belt **24** and projecting laterally therefrom are pairs of generally L-shaped pocket forming lugs **53** and **54**. These lugs are mounted on conveyor belt **24** with their base flanges overlapped and desirably are secured to the belt with the same bolts employed to secure drive lugs **52** thereto.

Referring for the moment to FIGS. 25 to 27, 30 and 31, each pocket forming lug **53** includes a pair of vertically spaced legs **55** which extend on opposite upper and lower sides of a carton guide rod **56** positioned to engage the outer side wall of each carton after the same is inserted into a receiving pocket. Guide rod **56** is suitably mounted to extend substantially the full distance from feed station B to discharge station L as shown in FIGS. 2 and 3. As shown in FIGS. 25, 30 and 31 guide rod **56** is properly positioned and maintained in a horizontal plane by means of suitable spaced brace structures **57** clamped to the frame of the machine.

The spaced legs **55** of each lug **53** extend a substantial distance beyond the outer edge of the respective lugs **54** and cooperatively provide a camming surface for a purpose to be described. As FIG. 12 shows, legs **55** are slightly angularly related relative to the body of lugs **53**. That is, legs **55** are inclined in a vertical plane to extend a limited amount toward an adjacent lug **54**. Each lug **54** has at the upper and lower extent of its outer edge a carton engaging and retaining finger **58** which is to engage the trailing portion of the outer side wall of a carton. Fingers **58** cooperate with the guide rod **56** in precluding collapsing of the cartons and outward movement of the cartons and dropping thereof during transportation by the conveyor.

It should be noted that although a pair of lugs **53** and **54** is bolted together that such a connected pair does not provide a carton receiving pocket therebetween. Rather, a lug **53** of one pair cooperates with a lug **54** of another pair to define a carton receiving pocket. The spacing between a lug **53** of one pair and a lug **54** of another pair is determined by the side wall width of the carton. Such spacing may be adjusted or modified as desired. As FIG. 12 shows, the carton transfer mechanism cooperates with a lug **53** in effecting setting up of a carton as will be described more fully hereinafter.

The Supply Hopper and Oscillating Carton Separating Device

Referring now to FIGS. 5 to 12, the supply hopper **61** which is positioned at station A will be described. Also, oscillating means mounted on the hopper for separating individual cartons from the remainder of the supply of cartons in the hopper also will be set out. Hopper **61** is of open work construction defined by a series of spaced elongated rods **62** which extend between and are fastened to suitable mounting plates **63** and **64** at the discharge end **66** and filling end **67** of the hopper respectively. As shown in FIG. 7, rods **62** are arranged in staggered relationship and provide the hopper sidewalls and bottom for retaining a supply of collapsed cartons in the hopper.

Movable means is mounted in the hopper **61** which is engageable with the rear end of the stack of cartons positioned therein and which applies pressure to the stack to urge the same continuously towards the discharge end **66** of the hopper so that the outermost carton in the stack is always properly positioned to be sequentially withdrawn by the transfer mechanism. Such movable means is in the form of a rolling carriage **68** mounted adjacent the bottom of the hopper and which is rollable on a mounting rod **69** extending the length of the hopper. Rod **69** desirably is rotatable as will be described hereinafter to preclude sticking of the carriage thereto and is mounted at opposite ends of the hopper in bearing plates **71** held in place by suitable bolts **72** or like fastening means as shown in FIG. 7.

Carriage **68** is defined by a front plate **73** and a rear plate **74** (FIG. 5) between which a pair of L-shaped braces **76** and **77** extend (FIG. 8). A series of low friction rollers **78** are bolted in pairs to each of the braces **76** and **77**. Each of such rollers is freely rotatable on the pivot bolts **79** employed for this purpose. Accordingly, the carriage is movable in either direction relative to discharge end **66** of the hopper. To preclude rotation or shifting of the carriage about the shaft **69**, a pair of rollers **80** are mounted on the front plate **73** of the carriage and are engageable with the spaced rods **62** which form the bottom of the hopper and which support the supply of cartons as shown in FIG. 8.

While various means may be employed for urging the carriage **68** towards the discharge end of the hopper, desirably the same is moved by means of a weight **81** connected by a cord **82** to the front plate **73** of the carriage, cord **82** being passed over a suitable pulley **83** mounted to the bottom frame of the hopper. See FIG. 5.

Extending upright from the carriage **68** from front plate **73** thereof is carton engaging structure **86** which comprises spaced upright extensions **87** to one of which is attached a suitable handle structure **88** (FIG. 6) by means of which the carriage may be withdrawn from the hopper discharge end so that the supply of cartons in the hopper may be periodically replenished. Attached to upright extensions **87** are a series of spaced carton engaging arms **89** having planar front surfaces which engage the rear carton in the carton stack and urge the same toward the discharge end of the hopper under the urge of weight **81** attached to carriage **68**.

Means is provided at the discharge end **66** of the hopper for restraining the cartons therein, and, referring to FIGS. 5 and 9, such means includes a pair of fixed carton retaining fingers **90** mounted on one side of the hopper and single fingers **91** at the top and bottom thereof so that the supply of cartons always is restrained on three sides against movement from the hopper. Such carton restraining means also includes an oscillatable device which is movably mounted at the side of the hopper opposite fingers **90** and which has as its intended function the periodic separation of single outermost cartons from the supply stack individually and at the proper time when a suction head of the transfer mechanism is presented to the hopper.

The oscillating device is shown at **92** in FIGS. 5 and 9 and comprises, as shown in FIGS. 11 to 11*e*, a flag device which includes a front leg **93** and a rear leg **94** mounted on a hub **95** and which define therebetween a clearance space **96** (FIG. 11*c*) which is of a width substantially the same as the thickness of a collapsed carton. That is, legs **93** and **94** are spaced from each other a distance substantially equal to the thickness of a carton. The legs of the flag device are tapered at their free ends and are arranged generally at right angles to each other with the rear leg **94** being somewhat shorter than front leg **93**.

Desirably, rear leg **94** is provided with a knife edge which facilitates insertion of such leg between the outermost carton and the second carton in the stack. Also, front leg **93** desirably slopes in a direction away from rear leg **94** to facilitate re-engagement of the front leg with the stack following carton separation by minimizing friction.

As shown in FIGS. 5 and 11*e*, flag device **92** is mounted on a horizontal shaft **97** which extends through a mounting block **98** which is secured to the hopper in any suitable manner. When the flag is in the position shown in FIG. 11*e* with the front leg **93** down or horizontal, leg **93** partially overlies the outermost carton and cooperates with fingers **90** and **91** so that all the cartons are retained in the hopper. However, when the front leg **93** is moved clockwise to the uppermost or vertical position as shown in FIGS. 5 and 9, the outermost carton is only restrained on three sides so that removal thereof may be effected by the transfer mechanism. Movement of front leg **93** is accompanied by movement of bottom leg **94** between the outermost and second cartons to effect separation of the outermost carton. However, removal of any carton other than the outermost is precluded by engagement of the rear leg with the second carton of the stack.

It should be understood that the flag device is oscillatable back and forth on shaft **97** through approximately 90° and that upon each oscillation of the flag the outermost carton in the supply will be separated from the remaining cartons in the stack so that it may be withdrawn. Such withdrawal is enhanced in that a carton held by a suction head of the transfer mechanism, after the same has been cleared from the hopper, may be slid over the outer face of front leg **93**. After separation of the outermost carton, the flag is again oscillated in the counterclockwise direction and front leg **93** is returned to the horizontal position.

The rear leg **94** of the flag thus performs the dual function of periodically separating the outermost carton from the remainder of the stack and also restraining the remainder of the stack in the hopper when such outermost carton is separated. It should be noted, however, that neither the front nor rear leg of the flag device applies any substantial pressure in a rearward direction to the stack. Rather, the stack is urged against the respective legs of the flag device by means of the weight **81** attached to the hopper carriage **68** as described previously. As a result, clockwise movement of front leg **93** does not produce axial compression of the stack; and after the outermost carton is withdrawn and the flag is rotated back to the position shown in FIG. 11*b* in which the front leg **93** is horizontal and the back leg is disengaged from the stack, the force of the weight **81** causes the supply of cartons to more or less jump the thickness of one carton until the stack engages front leg **93**.

FIGS. 11*a* and 11*b* illustrate movement of the flag device from the carton separating position shown in FIG. 9 to the carton restraining position in which the flag front leg **93** is in the horizontal position and the flag rear leg is free of engagement with the stack. In this connection, because of the partial overlap of the front and rear legs, the stack is restrained by the rear leg until the front leg has again been moved to the generally horizontal position, as shown in FIG. 11*a*.

To insure proper alignment and positioning of the cartons near the discharge end of the hopper with the oscillating flag, the mounting block **98** has secured thereto a pair of spaced guide rails **101** which are positioned above and below the flag substantially parallel to the flag mounting shaft **97** as shown in FIGS. 5, 9 and 11*e*.

To effect periodic oscillation of the flag so that the same is effective to separate the outermost carton from the stack in timed reltaionship with rotation of the carton transfer mechanism, a mechanical linkage is provided.

To permit carton pick-up, it is necessary that the oscillating flag front leg **93** be in the vertical carton separating position shown in FIG. 9 when a suction head of the transfer mechanism is brought into engagement with the outermost carton of the supply. As shown in FIG. 12 and as will be described hereinafter more fully, the respective suction heads of the rotary transfer mechanism are mounted on a continuously rotatable turret to which is attached for rotation therewith a cam ring **102**. Cam ring also is shown in FIG. 10 and comprises a series of projections **103** which extend outwardly beyond the circular periphery **104** thereof at equally spaced intervals therearound. The number of projections **103** employed will correspond to the number of suction heads mounted on the transfer turret. Cooperable with such cam ring and mounted to normally engage the same is a cam follower arm **106** (FIG. 10). A spring **107** is employed to normally urge the outer end of follower arm **106** adjacent ring **102** toward the outer periphery **104** of the cam ring. Cam follower arm **106** is mounted on a pivot pin **108** positioned intermediate its ends which is attached by a bracket **109** to the base upon which the transfer turret is mounted.

Cam follower **106** has a roller **111** mounted at the outer end thereof which is engageable with the periphery **104** of the cam ring **102**. As the ring rotates with the transfer turret, roller **111** moves about the periphery of the cam ring and periodically engages a projection **103** thereby causing cam follower **106** to oscillate each time the roller passes over a projection. When the roller is free of engagement with a projection, spring **107** returns it to engagement with the circular periphery of the cam ring.

The end **112** of the cam follower opposite from the outer end on which the roller **111** is mounted is connected by a linkage arrangement to the flag mounting shaft **97** described previously so that each time the roller **111** strikes a projection **103** on the cam ring **102**, the front leg **93** of the oscillating flag **92** is rotated clockwise (upwardly) thereby causing the rear leg **94** to enter between the outermost carton and the second carton of the stack to separate the outermost carton and allow the same to be withdrawn by a suction head presented thereto. When the roller **111** clears the projection, the linkage causes the flag front leg **93** to be oscillated counterclockwise to the carton restraining position.

Referring to FIG. 11, a desirable linkage employed to effect oscillation of the flag device is illustrated and comprises a push rod **113** hingedly connected at one end to the inner end **112** of the cam follower arm **106**. At its other end push rod **113** is pivotally connected by means of pin **114** to a bell crank **116** mounted on shaft

69 of the supply hopper 61 mentioned previously. Because bell crank 116 is pinned to shaft 69, movement of push rod 113 in either direction produces attendant rotation of shaft 69. Also pinned to shaft 69 adjacent to bell crank 116 is anotoher bell crank 117.

As FIG. 11 shows, the arms of bell cranks 116 and 117 are angularly offset and extend in different directions so that movement of push rod 113 to the right in FIG. 11 produces counter-clockwise rotation of shaft 69 and upward movement of bell crank 117 with shaft 69, and vice versa. Pivotally connected to the free end of bell crank 117 is another push rod 118 which extends in a substantially vertical direction and which is pivotally attached at its upper end to a third bell crank 119, which is immovably pinned to the flag device mounting shaft 97 described previously.

As a result of this linkage, when the cam roller 111 is engaged with the circular periphery of the cam ring 102 the flag is maintained with the front leg down or horizontal. However, when the roller engages a projection 103 on cam ring 102, the flag front leg is oscillated to the up or vertical position and the rear leg 94 is inserted between the outermost carton and the second carton in the stack.

Still referring to FIG. 11, when the turret on which ring 102 is mounted rotates in the direction of the arrow so that the roller 111 clears projection 103, the end 112 of cam follower arm 106 is urged by spring 107 to the right thereby pulling rod 113 in the direction of the arrow which in turn pulls the bell crank 116 to the right and produces attendant counter-clockwise rotation of shaft 69. This in turn moves bell crank 117 upward and, through push rod 118, causes bell crank 119 also to move upward to produce counter-clockwise rotation of flag mounting shaft 97 which moves flag front leg 93 from the up position shown to the down or horizontal position. When the cam roller 111 engages the next projection 103 on the cam ring this procedure is reversed and the various parts of the linkage are moved in the direction of the arrows shown in FIG. 11 to effect oscillation of the flag device in a predetermined manner to effect carton separation and permit carton withdrawal.

In this manner, as the turret on which the suction heads are mounted rotates, the outermost carton in the supply hopper is periodically separated at just the right predetermined moment at which a suction head is engaged thereto while the remaining cartons in the supply are retained securely in the hopper to preclude inadvertent separation thereof.

While in the embodiment illustrated, projections are employed on cam ring 102 to effect movement of the flag oscillating linkage as described, it should be understood that mechanical modifications of the illustrated arrangement also can be employed. For example, camming depressions extending into the outer periphery of cam ring 102 at spaced intervals therearound also may be utilized. Such a construction would require roller 111 on the outer end of cam follower arm to be let into the depressions to effect flag oscillation. Accordingly, the various components of the linkage would move in a manner and direction somewhat different from that described during carton separation. Also, the normal positions of the front and rear legs of the flag device would be modified with such a modified camming construction but the method of operation thereof would remain basically the same.

The exact linkage construction employed is not critical so long as it is effective to produce reciprocation of the flag device in timed relationship with movement of the conveyor and the carton transfer mechanism.

As mentioned previously, shaft 69 in the hopper serves as part of the operating linkage for the oscillating flag and periodic rotation thereof in opposite directions as the flag is oscillated insures that the carriage 68 of the hopper will not become stuck in one position so that cartons are continuously urged toward the discharge end of the hopper.

As shown in FIGS. 6 and 9 to 11, a stop member 121 is mounted on a slidable piston rod 122 which is controlled by an air cylinder 123 in a manner and for a purpose to be described. It should be noted, however, that if stop member 121 is urged into engagement with the inner end 112 of cam follower arm 106, roller 111 of the cam follower will be moved outwardly to a position entirely free of engagement with cam ring 102 and the projections 103 thereon so that operation of the flag mechanism may be suspended without stopping the remainder of the machine if so desired. Operation of air cylinder 123 will be discussed hereinafter.

The Carton Transfer Mechanism

The carton transfer mechanism, generally designated 125, is of the continuously rotating type which includes a rotatable turret 126 on which a plurality, desirably four, separate suction heads 127 are mounted. Each suction head includes a drive mechanism to be described which presents the head periodically to the feed hopper for picking up and withdrawing a carton and transferring the carton to the moving conveyor.

As shown in FIGS. 12 and 16*a* the turret 126 of the carton transfer mechanism is mounted on a base table 128 to which the vertical shaft 31 described previously is fixedly mounted. Turret 126 is rotated around shaft 31 by the chain 29 connected to sprocket 28 mounted on the conveyor sprocket 26 as described previously and as shown in FIGS. 4, 10 and 12. Shaft 31 is welded at 129 (FIG. 16*a*) or otherwise non-rotatably connected to the table base 128. A chain sprocket 132 is positioned on shaft 31 and is mounted thereon with suitable bearings 133 so as to be rotatable therearound. It is around this sprocket 132 that drive chain 29 passes whereby the suction turret is driven in timed relation with conveyor movement. Desirably a pair of chain tension sprockets 134 and 136 are positioned adjacent drive sprocket 132 as shown in FIG. 4 and in phantom lines in FIG. 10.

Mounting shaft 31 is hollow to provide a longitudinal passage 137 therethrough through which a vacuum atmosphere may be passed and periodically connected in sequential order to each of the four suction heads 127. Keyed to non-rotatable shaft 31 above sprocket 132 is a sun gear 138 which also is non-rotatable. Surrounding sprocket 132 and secured thereto for rotation therewith is a connecting plate 139 to the outer edge of which is mounted the cam ring 102 described previously. Connecting plate 139 defines the bottom of the rotary turret 126 of the transfer mechanism.

As illustrated best in the exploded view of FIG. 16, the driving mechanism for each suction head 127 may be considered to include a lower head structure 140 and an upper head structure 140' which are operatively and mechanically interconnected. The lower head structure 140 comprises a pair of inner and outer pinion gears 141 and 142 which are mounted on and for rotation with vertical stub shafts 143 and 144 respectively which in turn are positioned in suitable bearings 145 (FIG. 16*a*) secured in connecting plate 139. Inner pinion gear 141 is directly engaged with the teeth of sun gear 138 while outer pinion gear 142 is engaged directly with the teeth of inner pinion gear 141. This construction results in rotation of the inner and outer pinion gears in opposite directions when the drive sprocket 132 and the connecting plate 139 secured thereto are rotated. Because sun gear 138 is non-rotatably mounted on shaft 31, the pinion gears will rotate as in unison around sun gear 138 at the same time they rotate in opposite directions relative to each other.

Desirably, an upper connecting plate 146 is provided above the pinion gears and defines the top of the turret 126. It is to such upper connecting plate 146 that the vacuum control mechanism of the transfer mechanism is

mounted in a manner to be described. An annular cover 147 is positioned to extend between cam ring 102 mounted on connecting plate 139 and connecting plate 146 as a safety feature to preclude accidental engagement of a hand or the like with the movable pinion gears described.

To the upper ends of stub shafts 143 and 144 on which the pinion gears are mounted are secured crank members 148 and 149 respectively which extend parallel to the plane of plate 146. Bearings 150 are provided in plate 146 for these cranks and the stub shafts to which they are connected. At the free end of crank 148 is provided an upstanding motion transmitting pin 151 and a similar but shorter pin 152 is provided at the free end of crank 149. As shown in FIG. 16*a* each of the cranks 148 and 149 is positioned on the same level and overlies the respective pinion gear by which it is rotated. As a result of this construction the cranks 148 and 149 will rotate in opposite directions with their respective pinion gears and will at the same time be rotated in unison around sun gear 138.

A movable mounting platform 153 also comprises part of the lower head structure 140 and includes a front mounting block 154 from which a pair of parallel slide supporting rods 155 and 156 extend toward mounting shaft 31. A generally V-shaped rear mounting block 157 is immovably secured such as by a suitable pin or the like to the rear or innermost end of the rods 155 and 156.

Slidably mounted intermediate blocks 154 and 157 is a generally rectangular slide block 158 through which rods 155 and 156 pass. Rear block 157 and slide block 158 have extending vertically therethrough pin receiving bores 159 and 160 respectively which are intended to receive the vertical motion transmitting pins 151 and 152 extending upright from the cranks 148 and 149 respectively. As a result of this construction, upon opposite rotation of the pinion gears, pin 151 and crank 148 attached to inner gear 141 will cause the inner end of the mounting platform 153 defined by rear block 157 to move in one direction relative to a radius of the turret while pin 152 connecting crank 149 with slide block 158 will cause the front block 154 to move in the other direction. That is, upon rotation of the cranks in opposite directions, the center line 161 of the mounting platform, which lies between the axes of rods 155 and 156 and parallel thereto, will be moved in alternate directions across a radial line of the turret emanating from the axis of hollow shaft 31. The center line 161 of the platform will at all times correspond to and be coincident with a line connecting the vertical axes of pins 151 and 152. Such center line will coincide with a radius of the turret in the two occasions during rotation of the pinion gears when the cranks both extend in exactly the same direction. As a result a suction cup mounted on the suction head may alternately be moved between a fully extended and fully retracted position as the cranks rotate.

The upper head structure 140' will now be described. Pin 151 of crank 148 is of sufficient length to extend vertically entirely through bore 159 of rear block 157 of mounting platform 153 and is intended to have secured thereto an upper crank 162 which is secured for movement therewith by any suitable means, such as key element 163. Crank 162 is positioned in the same vertical plane as lower crank 148 but extends in a direction opposite thereto. Extending vertically from the free end of crank 162 is a motion transmitting pin 164 which is intended to be received in a vertical through bore 165 in a slidable generally V-shaped block 166 of an upper mounting platform 167. Block 166 is slidably mounted on a pair of parallel upper slide supporting rods 168 and 169 respectively which extend from and are immovable relative to an upper front mounting block 170. A center line 171 of the upper platform 167 extends parallel to and intermediate the axes of rods 168 and 169.

The upper front mounting block 170 includes a vertical column 172 on which the major suction cup 173 and minor suction cups 174 of the suction head are mounted. Upper front mounting block 170 also has a vertical through bore 175 therein which is intended to receive a vertical motion transmitting pin 176 which extends upright from the front block 154 of the lower mounting platform 153. The arrangement of the upper platform imparts a corrective motion to the movement of the lower platform so that the suction heads may be presented to the supply hopper and conveyor in a particular manner as will be described. The direction in which center line 171 extends corresponds to a line connecting the vertical axes of pins 164 and 176 at any given moment during rotation of the suction head.

It should be understood that each suction head 127 on the turret 126 desirably comprises an upper and lower head structure of the type described so that each head may be positioned in the same manner at a given location during rotation of the turret.

The purpose of the drive mechanism construction disclosed is to impart a particular motion and variable speed drive to the suction cup of each suction head 127 as the same rotates continuously at a uniform rate with the turret 126 about the axis of shaft 31. It has been known in the art heretofore to employ intermittent continuously rotating suction turrets for transferring cartons from a hopper to a moving conveyor but in such prior art devices the individual suction cups generally are presented to the carton supply in a generally tangential direction relative to the plane of the outermost collapsed carton so that the cup is wiped across the face of the outermost carton during the withdrawal operation. Such wiping motion frequently results in dropped cartons, particularly if an attempt is made to rotate the turret continuously at a high speed so that the suction cup is presented to the outermost carton for a very brief period of time.

With the subject transfer mechanism, however, the suction cups of each suction head are presented to the supply hopper 61 in a manner so that the cups engage the outermost carton from a direction which is generally normal or perpendicular to the plane of the outer face of the outermost collapsed carton as shown in FIG. 12. That is, the transfer mechanism of this invention eliminates the heretofore employed tangential wiping motion and presents each suction cup in a generally straight line direction into engagement with the outermost carton in the hopper without interrupting rotation of the turret. Each cup has been moved to its fully extended position at the time the oscillating flag mechanism 92 is moved to the carton separating position described previously. By eliminating tangential or wiping motion of the suction cup relative to the outermost carton, each carton may be firmly and surely grasped by a suction cup and carton dropping precluded even though the turret is rotating feeding speeds up to 200 or more cartons per minute. Furthermore, each cup is imparted with a momentary stationary dwell as the carton is engaged which further enhances carton pick up.

Separation of the outermost carton is accompanied by a withdrawal of the suction cup in a substantially radial direction relative to the axis of shaft 31 for at least a short distance and along the center line of the hopper so that the outermost carton is drawn over the fingers 90 and 91 of the hopper and partially opened thereby before the carton is moved by the suction head toward the conveyor moving relative thereto. During the period of transfer, the velocity of a suction cup on a suction head varies from the momentary stop when the carton is picked from the hopper, through a period when the cup velocity is increased so that the carton carried can overtake a conveyor pocket and strike a lug thereof, and then decreases to correspond with the speed of the conveyor and momentarily stops (during radial reversal of direction) when the erected carton is released to the conveyor pocket. It should be remembered, though, that the turret 126 rotates continuously and at a uniform speed throughout each revolution. As the conveyor is driven in direct

timed relationship with the transfer mechanism, individual cartons are sequentially placed into the line of conveyor pockets automatically.

The motion and path of movement imparted to a suction cup by the driving mechanism of suction head during rotation of the turret is illustrated in FIGS. 19 and 19*a*. As noted in FIG. 19*a*, the arrangement of the mechanism is such that the suction head is fully extended three times at 120° apart locations during one revolution of the turret; the first time being when the suction cup is presented to the supply hopper, the second time being when the carton is presented to the conveyor pocket, and the third time being a rest position. As FIG. 19*a* also illustrates, the suction cup is drawn to the fully retracted position fairly soon after the carton has been withdrawn from the hopper and after the same has been presented to the conveyor so that the carton may be retracted and cleared from the hopper and the suction cup may be moved away from the conveyor after the erected carton has been positioned in the conveyor pocket. Except for the three fully extended positions shown, the path of the suction cup is generally circular. When the cup is in its fully extended position it is momentarily motionless, at which time generally radial outward direction of movement is reversed or changed to generally radial inward movement.

Because the motion imparted to the suction cup by the mechanical driving mechanism disclosed is difficult to visualize, attention is directed to FIGS. 19*b* and 19*c* which schematically show the positions of the center lines of the lower platform **153** and upper platform **167** of a suction head at various stages during movement of a carton from the hopper to the conveyor. As shown, approximately 120° is traversed by the suction head between removal of a carton from the hopper and release of the carton to the conveyor pocket. As noted previously, the upper structure **40'** of the suction head imparts a corrective feature to the in-out motion imparted to the suction cup by the lower structure **40** so that cartons are properly withdrawn from the hopper and presented to the conveyor. FIG. 19*b* illustrates the direction in which the center line **161** of the lower mounting platform **153** extends at various locations. If major suction cup **173** were mounted directly to this lower platform, each carton **1** would be positioned as shown, namely normal to the center line **161**. Such construction would result in the center line being parallel to a radius of the turret for only the brief instant when the suction cup is fully extended or retracted, that is, when cranks **148** and **149** extend in the same radial direction. This would not produce the most effective carton withdrawal from the hopper or carton engagement with a conveyor pocket to effect erection of the carton.

The machine disclosed herein desirably employs a sun gear **138** having 72 teeth while each of the pinion gears is provided with 24 teeth. This results in the pinion gears each rotating about their own axes one full revolution while the pinion gears as a unit are rotated about the axis of the sun gear one-third of a revolution, or 120°. Because the position of center line **161** of the lower platform **153** corresponds at any given moment to a line connecting the axes of pins **151** and **152** rotatable with lower cranks **148** and **149**, and because cranks **148** and **149** are continuously rotating in opposite directions, center line **161**, after each 30° of rotation, is directed as shown in FIG. 19*b*.

To insure separation of a carton from the hopper and proper engagement of the carton with a conveyor pocket in the most effective manner, the correcting feature imparted by the upper suction head structure **140'** is provided. This correcting feature is illustrated in FIG. 19*c* which shows that the center line **171** of the upper platform **167** is positioned generally parallel to a given radial line of the turret during a predetermined period of rotation and for more than a brief moment as is true of the center line **161** of the lower platform **153**. That is, as the turret rotates past the three locations during each revolution at which each major suction cup **173** is fully extended, the center line **171** of upper platform **167** is maintained generally parallel to the radial line which passes through each such location as each suction head approaches and leaves each such location. As noted previously the direction in which center line **171** on which major suction cup **173** is mounted extends is determined by the relative positions of pins **164** and **176**.

The upper crank **162** and mounting platform **167** do not affect the distance to which the suction cup **173** is extended relative to the axis of the turret; such distance control is provided by the lower head structure **140**. The upper crank and platform control the direction or position in which the suction cup is presented at various stages of rotation and effects periodic changes in the velocity at which the suction cup travels relative to the conveyor; the object being to maintain the collapsed carton generally in a plane which is as close to being perpendicular to the three radial lines passing through the turret at the three locations at which the suction cup is fully extended while at the same time eliminating the previously discussed wiping motion when a carton is withdrawn from the hopper and without interrupting rotation of the continuously rotating turret.

By comparing FIGS. 19*b* and 19*c*, the corrective directional feature imparted to the suction head by the upper head structure **140'** at the time of carton pick up and deposit into a conveyor pocket should be evident. Although the center line **171** of the upper platform **167** and the center line **161** of the lower platform **153** lie in the same vertical plane when the suction cup is fully extended and fully retracted at each 60 degree position, the correction imparted to the center line of the upper platform on which the suction cup is mounted is evident in the intermediate positions lying between the fully extended and fully retracted positions. By properly relating the relative lengths of the upper and lower cranks, the position of the plane of a carton engaged with a suction cup may be varied as desired.

The schematic showing of FIG. 19 illustrates in detail the particular motion imparted to a suction cup, including its generally straight away withdrawal from the hopper and its presentation in a direction substantially normal to a lug **53** carried by the conveyor belt **24**. This latter feature is illustrated also in the sequence of operations shown in FIGS. 15*a* to 15*f* which show the novel cooperation of the subject suction head with a continuously moving conveyor pocket. The suction cup is carried by the turret, at least for a period of each revolution, at a speed greater than the speed of movement of the conveyor so that the cup may overtake the conveyor and force the leading edge of the carton against the large lug **53** of the conveyor pocket in a direction substantially normal thereto, which results in complete and automatic transformation of the carton to the erected state without employing auxiliary carton engaging opening means. As this sequence shows, when the carton is substantially fully erected, the suction cup speed is reduced automatically by the transfer mechanism to correspond briefly with the conveyor speed and the erected carton is moved radially outwardly and is engaged fully into the pocket. At that time, fingers **58** of the trailing lug **54** engage the carton, and suction to the cup is automatically cut off and the cup withdrawn as shown in FIG. 15*f*. Engagement of a carton in a pocket is facilitated due to the fact the transfer mechanism is positioned adjacent the conveyor in a location where the conveyor path is arcuate, rather than straight, as shown in FIG. 12. As a result, trailing lug **54** may overtake and firmly engage the trailing portion of a carton.

The Suction Control Means

Because of the novel cooperation between the suction head, the supply hopper, and each pocket of the conveyor,

the timing of the application and cut off of suction to each suction head is important. Such timing is controlled by means mounted on the non-rotatable shaft **31** about which the respective suction heads are rotatable. As shown in FIGS. 20 to 23, taken in conjunction with FIG. 16*a* described previously, the suction control means comprises a lower disc member **181** which is secured by means of a pair of vertically extending pins **182** and **183** to the rotatable connecting plate **146** of the turret mechanism so as to be continuously rotatable therewith. Desirably, coil springs **184** and **186** are positioned around pins **182** and **183** to urge disc **181** upwardly. A suitable bearing sleeve **187** is interposed between non-rotatable shaft **31** and disc **181** and it is about such bearing sleeve that disc **181** rotates.

A second disc **188** is non-rotatably secured to shaft **31** and is positioned above disc **181**. Discs **181** and **188** are urged into frictional but relatively movable engagement by means of a threaded nut **189** which urges a pressure sleeve **191** downwardly against a washer member **192** seated in the upper surface of the disc **188**, and by springs **184** and **186** which urge lower disc **181** upwardly.

As shown in FIG. 20, an automatic oiler device **193** is mounted by means of a threaded shaft **194** to the top of non-rotatable shaft **31**. A supply line **196** depends from the bottom of the oiler device **193** and is secured over an upstanding nipple **197** extending upwardly from a vertical recess **198** extending through upper disc **188** and communicating with a substantially radial slot **199** provided in the bottom thereof. A suitable pad of felt or the like desirably is provided in slot **199**. Lubricating oil is deposited in controlled quantities in a well known manner through supply line **196** onto the oiler pad in slot **199**. As disc **181** rotates relative to fixed disc **188**, a thin film of oil is deposited thereon thereby providing a lubricating film, such oil film also serving as a barrier to preclude loss of vacuum between the relatively rotatable discs.

Referring to FIGS. 20 and 22, the lower rotating disc **181** is provided with four vertical passages **201** with which radially extending hollow nipples **202** communicate. It is to an end of each of such nipples **202** that a flexible rubber or plastic tube **203** is secured for connecting the respective suction heads to a vacuum source. The purpose of the vacuum control mechanism is to permit suction to be applied to the individual suction heads as each is presented to the supply hopper so that the outermost carton may be withdrawn in the manner described and to maintain suction on the respective heads until the carton transferred thereby is properly positioned in the conveyor pocket intended therefor. As mentioned previously, non-rotatable shaft **31** is hollow and is provided with a longitudinal passage **137**. This passage is connected adjacent its bottom with a suitable source of vacuum by means of threaded connector **206** (FIGS. 16*a* and 20).

Adjacent its upper end shaft **31** is provided with a pair of radial passages **207** (FIGS. 20 and 21) for the passage of vacuum into an annular groove **208** aligned therewith and provided in upper fixed disc **188**. Emanating from annular groove **208** are a series of substantially radially extending passages **209** which connect annular groove **208** to an arcuate vacuum control channel **211**. The center of arcuate control channel **211** is spaced from the axis of shaft **31** a distance equal to the spacing of each of the axes of the vertical passages **201** mentioned previously which are formed in lower rotating disc **181**. As disc **181** rotates relative to upper disc **188**, each of the passages **201** will be connected with the vacuum source of supply for a given time interval determined by the arcuate length of channel **211**.

The upper disc **188** is so oriented and vacuum channel **211** is of such arcuate length that vacuum is applied to each of the respective suction heads through the connecting tubes **203** commencing at the point when each suction head is presented for engagement with the outermost carton of a supply and suction is maintained on such head during approximately 120 degrees of rotation of the transfer turret until the carton is fully erected and positioned in a conveyor pocket, at which time the vertical passage **201** connecting such head to the vacuum supply passes beyond the arcuate extent of the channel **211** and vacuum thereto is automatically cut off. In this manner suction is periodically and sequentially applied to each of the suction heads when a carton is carried thereby while suction is cut off from the heads not engaged with a carton to prevent vacuum loss in the system.

Because it occasionally is desirable to run the carton transfer mechanism without having the same pick up cartons, suitable means is provided with the vacuum control arrangement to allow vacuum to be cut off to the respective suction heads as desired. Such cut off means comprises a push-pull rod **216** slidably mounted in the longitudinal passage **137** of shaft **31** to which are attached a lower sealing piston element **217** slidably mounted in the bottom of passage **137** and an upper sealing piston element **218** slidably mounted near the top of the passage **137** above radial passages **207** described previously.

Suitable mechanism to be described is connected to the lower piston element **217** for effecting movement of the push-pull rod **216** in a given manner. A rocker arm **219** is pinned in a radial passage **221** through the upper end of shaft **31** and the sleeve **191** surrounding the same. One end of such rocker arm is pivotally connected to the upper piston member **218** on rod **216** while the outer end of the arm is pivoted to an upright plunger **222** slidably positioned in a through bore **223** through upper fixed disc **188** which communicates with the arcuate control channel **211** described previously. A control shoe **224** is secured to the bottom of plunger **222**, is positioned in control channel **211** and is movable with the plunger when the same is actuated by the rocker arm **219**.

When the control shoe is in the up position shown in FIGS. 20 and 23, vacuum may be applied to each of the suction heads periodically in the manner described previously. However, if the push-pull rod **216** is moved upwardly from the position shown in FIG. 20 the plunger **222** will be moved downwardly to urge control shoe **224** into contact with the upper planar surface of rotating disc **181**. As a result, when an upright vacuum passage **201** passes beneath arcuate control channel **211** the downwardly moved shoe **224** will preclude vacuum flow into passage **201** at the time when the suction cup is presented to the supply hopper thereby precluding carton pick-up. Normally, however, the control shoe is free of engagement with the upper surface of disc **181** and does not preclude such carton pick-up. If desired a leaf spring **226** may be mounted on a positioning bolt **227** and engaged with the upper end of plunger **222** to balance operation of the rocker arm **219**.

Again referring to FIG. 20, bottom piston element **217** secured to push-pull rod **216** is in turn connected to a flexible cable **231** slidably mounted in a clamp arrangement **232** connected to the bottom of hollow shaft **31**. Movement of such cable **231** up or down produces attendant movement of the control shoe **224** described previously. Because control shoe **224** does not fill the full arcuate length of control channel **211**, if a carton already has been picked up by a suction head, such carton will not be dropped if the control shoe is lowered in that the shoe cuts off the vacuum supply only at the time a suction cup is presented to the hopper but does not affect the vacuum applied to a suction head thereafter.

Referring now to FIGS. 9 to 11, flexible cable **231** is secured at its other end **233** to a sliding platform **234** on which the control stop member **121** mentioned previously with respect to the oscillating flag device also is

mounted. This platform in turn is connected to the slidable piston **122** regulated by air cylinder **123** also mentioned previously. As piston **122** is extended by air cylinder **123** flexible cable **231** will be moved longitudinally and will be forced upwardly through shaft **31** in FIG. 20 causing the control shoe **224** to preclude carton pick up as described.

Air cylinder **123** may be regulated in any suitable manner but desirably is connected by conventional mechanism to a solenoid switch and valve which is electrically connected to and regulatable by a feed control button on the machine control panel **235** conveniently located near the carton transfer mechanism as shown in FIG. 2, and by a cam operated switch as will be described. As the control button on the control panel is depressed, air cylinder **123** is actuated to extend piston **122** and to move control shoe **224** to the down position. In this manner, suction may be cut off from the suction heads as they are presented to the feed hopper without affecting rotation of the suction turret.

As piston **122** is extended, the control stop **121** also is carried thereby into engagement with the cam follower arm **106** which is operatively connected to the oscillating flag device **92** mentioned previously. As a result, the cam roller **111** mounted on the free end of the cam follower may be moved outwardly away from the cam ring **102** to render the linkage between the cam follower and the flag device inoperative to prevent the flag device from separating cartons when suction is not applied to the respective suction heads. Therefore, cartons are not separated and dropped from the hopper if the suction heads are not intended to pick up cartons.

The aforementioned solenoid is connected by a suitable electrical circuit to the aforementioned machine feed control button positioned on the control panel **235** of the machine. The feed control button is connected in an electrical circuit which requires the button to be held down until a second cam follower **236** (FIGS. 10 and 12) contacts one of a series of cam projections **237** spaced about the outer periphery of upper connecting plate **146** so that another switch which controls the solenoid is actuated thereby to effect withdrawal of the piston **122** of air cylinder **123** and movement of the stop member **121** out of engagement with the cam follower **106** operatively connected to the oscillating flag device **92**. In this manner, operation of the flag device is controlled until a suction cup is presented to the outermost carton in the supply so that the same may be picked up. Also, the timing of the vacuum cut off is controlled so that a carton which has been previously picked up by a suction cup will not be dropped. When the feed control stop button on control panel **235** is pushed, the holding circuit previously established by the switch actuatable by cam follower **236** is broken so that the cam follower is disengaged. Although cam follower **236** is operatively connected to the solenoid for regulating the air cylinder which operates the flexible cable **231**, the same has no effect on the vacuum control arrangement during normal operation of the machine.

As mentioned previously, major and minor suction cups are employed with each suction head and are mounted on upright column **172** thereof. The cup constructions are shown in FIGS. 17, 17*a*, 17*b* and 18. Major cup **173** is of generally standard construction including the usual rubber cup and comprises a metal body **238** to which the rubber cup is secured. Body **238** is provided with a through bore **238'** connected by a suitable nipple arrangement **239** to a flexible hose **203** which is connected to the vacuum control arrangement mentioned previously. A branch nipple **239'** also is connected to the vacuum supply for operatively connecting the minor cups to the vacuum supply as shown in FIG. 16*a*.

If desired a spring loaded control valve **240** including a carton actuatable plunger also may be provided on the major suction cup. By means of a sealing ring **240'**, vacuum is precluded from passing past the plunger valve **240** when the same is not engaged with a carton; that is, when the valve is extended as shown in FIGS. 17 and 19*a*. However, if the suction cup **173** is presented to a carton, the plunger valve is depressed by the carton and suction can be applied to the carton for picking up the same.

If desired the minor suction cup shown in FIG. 18 also may be provided with a spring loaded valve. Because of its small size, cup **174** is formed substantially entirely of nonmetallic material having a metal core attachable to the vacuum source.

As shown in FIG. 13*a*, major suction cup **173** is intended to engage side wall **2** of a carton centrally thereof while the upper and lower minor cups **174** are intended to engage the carton liner **11** just above and below the respective upper and lower cover flaps **8** attached to side wall **2**. Minor cups **174** thus preclude liner distortion and damage by preventing the inner liner faces from sticking together and tearing as the carton is erected. Also, cups **174** prevent premature inward tucking or folding of the liner ends as a result of air rushing into the carton as the carton is rapidly erected.

The Flipper Arms

Referring to FIGS. 2, 4 and 24, after the cartons are inserted by the rotary transfer mechanism in fully opened condition into receiving pockets on the conveyor, the same are carried by the conveyor past a pair of upper and lower flipper arms **241** and **242** which are mounted at station C on the flexible shaft **41** rotated by the drive shaft **37** as described previously.

Flexible shaft **41** is of the type commonly employed for speedometer cables in automobiles and the like and includes an inner motion transmitting metal core surrounded by a woven covering. As shown in FIG. 24, upper flipper arm **241** is mounted to the end of shaft **41** while lower flipper arm is mounted at a point spaced between the end of shaft **41** and its connection to drive shaft **37**. Suitable braces **243** and **244** respectively are attached to the frame of the machine to position the flipper arms for rotation in a vertical plane about horizontal axes defined by the respective portions of flexible shaft **41**. The purpose of the flipper arms is to insure that opposite ends of each carton are fully opened and unrestricted. The flipper arms serve as a safety feature to insure that ridge flaps **9** of each carton and the liner secured thereto are vertically positioned.

The flipper arms enter the mouths of the carton as shown in FIG. 24 and strike the inner surface of the carton liner to kick the same and the ridge flaps secured thereto to the vertical position should the same be somewhat bent inwardly due to a minor carton imperfection or the like. Rotation of the flipper arms is in a direction toward the side wall of the carton engaged with the conveyor belt and is timed so that the pair of flipper arms enter opposite top and bottom ends of each carton as it is carried past the station at which the flipper arms are mounted.

The Carton End Closing Mechanism

Referring now to FIGS. 24 through 28, the mechanism positioned at station D for folding and closing the bottom end of each carton moved therepast by the conveyor desirably comprises a pair of movable tucker arms **246** and **247**. Front arm **246** is intended to engage and kick in the leading triangular tab **7** at the bottom end of the carton while rear arm **247** is intended to be moved into overtaking relationship with and kick inwardly the trailing triangular tab **7** of each carton. Also, a suitable plow arrangement to be described cooperates with the tucker arms to effect complete carton end closing without liner or carton damage. In this manner, the carton liner **11** is folded inwardly with the triangular tabs and a gusset type fold imparted thereto. Because the liner is adhesively connected to the cover flaps **8** and ridge flap **9** at op-

posite ends of the carton, movement of the carton liner in the manner described will tend to draw therewith the respective flaps attached to the side walls of the carton thereby facilitating carton end closing.

Because the carton liner extends beyond the outer extremities of the triangular cover tabs **7** and is secured to cover flaps **8** and ridge flaps **9** it is not feasible to employ a stationary plow device intended to engage the leading tab **7** to depress the same in that such a stationary plow device would tear the carton liner as the same engages the plow. Accordingly, the oscillatably movable front tucker arm **246** is employed in that the same can be moved upwardly into momentary engagement with the leading triangular tab **7** and can be rapidly withdrawn therefrom after the same has been kicked inwardly. Nor would a stationary plow alone be effective to fold the trailing tab **7** forwardly in the direction of movement of a carton. This function is performed effectively by the oscillatable rear tucker arm **247**.

The relative condition of a carton bottom end before and after the same has been engaged by the pair of tucker arms and the cooperating plow arrangement is illustrated in FIGS. 25 and 26 respectively.

Cooperable with the tucker arms to effect complete closing of the carton end, a suitable stationary converging plow device is provided. As shown in FIGS. 24 and 26, such plow device is defined in part by a pair of opposite converging inner and outer plow elements **248** and **249** which are mounted by spacer bolts or the like to the frame of the machine on opposite sides of the tucker arms. A pair of inner and outer parallel guide elements **250** and **251** complete the plow device and are aligned with the plow elements **248** and **249** for completing carton end closing and for maintaining each closed carton end in the folded condition as the carton is transferred to a heat sealer. Plow elements **248** and **249** converge towards each other in the direction of movement of the carton so that when end closure of the carton has been initiated by the tucker arms the closure is completed substantially simultaneously by the plow device as the cartons are moved therethrough. That is, the carton end is imparted with a gusset folded substantially planar extremity defined by the bottom flaps and liner of the carton folded into face-to-face engagement. Also, the cover flaps **8** are folded into a substantially horizontal plane.

The front and rear tucker arms **246** and **247** desirably are actuated from a common drive shaft **47** operatively connected to the power source **15** of the machine as shown in FIG. 4. Such drive shaft, as shown in FIG. 26, passes through a suitable bearing sleeve **252** secured to a brace **253** mounted on the machine frame beneath the conveyor. A crank element **254** is keyed to the end of drive shaft **47** for rotation therewith and in turn is operatively connected by means of stub shaft **256** to the rear tucker arm **247**. Front tucker arm **246** is secured at its lower end to a bearing sleeve **257** which surrounds stub shaft **256**. As crank **254** is eccentrically rotated by drive shaft **47**, attendant rotation is imparted to stub shaft **256** which produces desired movement of each of the tucker arms.

A suitable spacer block **258** is mounted adjacent the top of front tucker arm **246** so that the upper reach of such arm may be positioned in line with the upper reach of rear tucker arm **247** and centrally of the path of carton movement. While in the embodiment illustrated the upper reaches of the respective arms are shown as separate elements bolted to the arms proper, if desired the arms could be of one piece construction.

To impart the desired direction and motion to the oscillating tucker arms suitable cam slots **259** and **261** are provided in the front and rear arms respectively intermediate ends of the arms. A cam guide roller **262** is mounted on a suitable brace **263** and extends through slot **259** in front arm **246**. Likewise, a cam guide roller **264** is secured to a brace **266** and extends through the slot **261** in rear tucker arm **247**. As shown in FIGS. 24 and 28*a* through 28*d* the cam slot **259** in front tucker arm **246** is substantially straight so that when crank **254** rotates a generally up and down reciprocating motion is imparted to the front tucker arm. Such motion moves the tucker arm into direct periodic engagement with the leading triangular tab of each carton bottom end to kick the same inwardly just prior to engagement of the carton with the plow device provided. Movement of the upper reach of the front tucker arm **246** follows a generally elliptical path which has its major axis at a slight angle relative to the vertical.

The cam slot **261** in rear tucker arm **247** is of arcuate configuration so that the rear tucker arm is moved not only in a vertical path but simultaneously is reciprocated in a generally horizontal path upon rotation of crank **254**. In this manner the rear tucker arm is able to move upwardly and overtake the trailing triangular tab of each carton from the rear to kick the same in the direction of carton movement before the trailing portion of the carton end enters the plow device. The sequence of operation of the tucker arms and their manner of engagement with the cartons are illustrated in FIGS. 24 and 28*a*–28*d*. The tucker arms are driven in timed relationship with conveyor movement. Because of the novel scissors-type reciprocating movement of the two tucker arms relative to each other, proper inward face-to-face folding of the carton liner may be effected without damage thereto, in the manner illustrated.

If desired a guide plate **267** may be secured to the machine frame intermediate opposite ends of the tucker arms to steady the same during reciprocation thereof and maintain rollers **262** and **264** in their respective cam slots.

The Heat Sealer

After each carton bottom end has been closed by the tucker arms and plow device as described, the cartons are carried by the conveyor to a suitable heat sealing device positioned at station E. Various suitable heat sealing constructions are commercially available and the particular arrangement of the heat sealer employed is not intended to be part of this invention. However, as shown in FIGS. 24, 27 and 29, the heat sealer chosen desirably comprises a pair of rotatable inner and outer metal belts **271** and **272** respectively. Such belts rotate about and are driven by a series of pulleys **273**, one of which may be driven in any suitable manner, and preferably is driven from the main power source **15** of the machine through jack shaft **32** as shown in FIG. 4. It generally is sufficient to drive one pulley for each belt with the other pulleys being driven by friction or the like therefrom.

Adjacent pulleys **273** are spaced slightly from each other whereby a channel is provided between the belts so that a folded carton extremity may pass therebetween. Substantial pressure is applied to the carton extremity by the belts and heat from heating units **274** is transferred by the belts to the ridge flap **9** on one side of the carton extremity and directly to the outer surface of the folded carton liner at the other side of the carton folded extremity to effect complete heat sealing of the liner. The belts are driven at substantially the same rate of speed as the conveyor so that movement of the cartons therethrough is smooth and uninterrupted. If desired, scraper devices or blades **275** may be provided for cleaning off any wax or like residue that may be deposited on the belts during their engagement with the respective cartons.

The Filler

After heat sealing each of the cartons is ready to be filled with its intended product, which may be edibles or juices intended to be subsequently frozen, or non-edibles such as motor oils and the like. Because the heat sealing operation is very effective, fluid leakage is precluded from the carton after such sealing.

The filler **276** chosen for the subject machine may be

any one of several commercially available types but desirably is of the rotary type which is mounted upon and continuously driven by the conveyor sprocket **23**. Such filler desirably comprises a series of separate discharge containers into which measured quantities of product are automatically fed from a feed hopper and from which such quantities are metered into the cartons passing therebeneath and moving therewith in a well known manner as schematically shown at station F in FIG. 1.

It is desirable that a "no-carton, no fill" detector be employed with the filler to preclude wastage and mess if a carton is missing from a conveyor pocket. Such detectors are well known in the art.

As shown in FIG. 31, during and after filling, the cartons are supported on spaced apart rails **277** and **278** which extend along the machine beneath the conveyor from station E to station I.

The Carton Cleaning Apparatus

Occasionally during high speed filling a slight amount of spillage or overflow runs over the top of the open carton onto the side of the ridge flap **9** and cover flap **8**. Accordingly, as shown in FIGS. 1 and 32 to 34, suitable cleaning apparatus desirably is provided at station G for removing any such spillage. Such apparatus includes a spray nozzle **281**, which deposits a fine spray of cleaning water or the like onto the upper portion of the carton as the same is carried therepast; a vacuum head **282** connected to any suitable vacuum source **283**, such as a commercial vacuum cleaner; and a rubber or like wiper blade **283'**, which cooperates with vacuum head **282** in removing water and any product spillage prior to sealing of the carton end. Any excess water or product spillage not removed by the vacuum head is wiped from the cartons by blade **283'**. Suitable guide rods **284** are provided across the front of the vacuum head **282** to prevent distortion of the cartons when the same are subjected to the vacuum cleaning operation.

If desired a similar vacuum cleaning apparatus may be mounted to clean the outside face of the carton if the same is found to be necessary.

The Carton Top End Closing and Sealing Mechanism

Following cleaning of the filled carton at station G as described, the cartons are transported to station H where a pair of oscillatable tucker arms and a plow arrangement identical to those employed at station D for closing the carton bottom end are positioned. However, the tucker arms and plow device at station H are mounted in inverted fashion above the conveyor and the arms move in a reciprocating fashion downwardly into periodic contact with the trailing and leading triangular closure tabs at the top of the carton in the same manner as that employed for closing the carton bottom as described previously. The upper tucker arms are designated **285** and **286** and the plow device is **287** in FIG. 1. The tucker arms are driven by a stub shaft and crank arrangement from drive shaft **43** connected to the main power source **15** of the machine in the manner shown in FIG. 4.

A heat sealing device **288** of the same type as that employed at station E is positioned at station I for sealing the carton top extremity after the tucker arms and plow devices at station H have performed their function. The heat sealer at station I also is mounted in inverted position.

Final Machine Operations

Following top sealing, each carton is in the condition illustrated in FIG. 36 in which opposite sealed extremities of the carton extend in a straight direction away from the top and bottom of the carton as shown. Because the carton in this condition is somewhat bulky to handle and cannot easily be overwrapped with advertising material or the like, it is desirable to fold down the sealed extremities and suitable plow devices are provided at station K for such folding. However, it is first preferred to apply a suitable adhesive to the outer surfaces of the pair of cover flaps **8** which are free of engagement with ridge flaps **9** so that such ridge flaps and the sealed carton liner extremity connected thereto may be held down in engagement with the cover flaps **8** as shown in FIG. 37 to provide a neat, compact package.

To effect application of adhesive, a suitable applicator device is provided at station J by means of which adhesive may be applied prior to the folding operation performed at station K. The adhesive applicator **291** (FIG. 1) may be of any conventional construction so long as it is capable of applying adhesive uniformly and in controlled amounts to rapidly moving cartons. Application may be effected by squirting the same onto the cartons under pressure or by using rollers of the well known type which apply adhesive by direct contact. Desirably a supply tank **292** is provided in which a quantity of molten adhesive is retained for use. After application of the adhesive at station J, the cartons are transported past upper and lower plow devices **293** and **294** respectively as shown in FIG. 35 to effect folding over of the sealed extremities against the cover flaps **8** at upper and lower ends of the cartons.

Because it takes a short period of time for the adhesive thus applied to set, a pair of upper and lower pressure belts **296** and **297** are provided at station L for maintaining the sealed carton extremities in the folded position. Belts **296** and **297** also perform the function of conveying the filled, sealed and folded cartons away from the main conveyor of the machine. As shown in FIGS. 3 and 4 the pressure belts **296** and **297** are driven in opposite directions by drive chain **39** passing over a drive sprocket **38** connected to the drive shaft **37** as described previously.

A second pair of upper and lower belts **298** and **299** also are provided at station L and form a supplemental section of the take-off conveyor. By means of an interconnected chain drive **301** (FIG. 3) the belts **298** and **299** are driven from the same power source as the first set of belts **296** and **297**. By employing a suitable gearing arrangement, the speed of belts **298** and **299** is maintained less than the speed of belts **296** and **297** so that cartons transferred from the first set of belts to the second set are brought into contacting relationship with each other, thereby requiring a shorter conveyor section to effect setting of the adhesive on the cartons.

Following complete setting of the adhesive, if the cartons are to be overwrapped, they may be transferred directly to an overwrap machine at which a suitable wrapper may be applied and/or, if the cartons are filled with a product to be frozen, they may be transferred to a freezing apparatus.

While one particular embodiment of the subject machine and method of filling and sealing cartons has been disclosed herein, it should be understood that modifications thereof which may become apparent to one skilled in the art should be included in this invention and that the same should be interpreted in light of the appended claims.

We claim:

1. A carton erecting and filling machine comprising a supply hopper in which a stack of collapsed cartons are retained, a conveyor moving continuously and at a predetermined uniform rate relative to said hopper and having carton receiving pockets thereon each of which is defined by a pair of spaced apart lugs, mechanism for withdrawing sequentially individual outermost cartons from said hopper and transferring the same to said conveyor; such carton transfer mechanism comprising a turret rotatable about an axis continuously and at a uniform rate timed with respect to movement of said conveyor, a plurality of carton engaging heads mounted on said turret each of which includes means for grasping a carton at said hopper and holding the same during transfer to said conveyor, drive mechanism for each head whereby the grasping means thereon is periodically extended and

moved in a direction opposite to rotation of said turret as said head is presented to said hopper then retracted to withdraw a carton and subsequently extended as said carton is presented to said conveyor, the drive mechanism presenting the respective grasping means to said hopper in a direction generally normal to the plane of the outermost collapsed carton in said stack whereby wiping motion of the grasping means relative to such outermost carton is precluded without altering the rate of rotation of said turret, each grasping means after withdrawal of a carton from said hopper being movable on said turret by the drive mechanism in the direction of turret rotation to overtake a leading lug of a conveyor pocket and being cooperable solely therewith in transforming the carton carried thereby to the erected condition; and means driven in timed relationship with said conveyor positioned along the path of movement of said conveyor for sequentially closing and sealing one end of each of the series of cartons in said conveyor pockets, filling the respective cartons with a predetermined amount of product, and closing and sealing the other end of each carton to retain the product therein.

2. A carton erecting and filling machine comprising a supply hopper in which a stack of collapsed cartons are retained, a conveyor moving continuously and at a predetermined uniform rate relate to said hopper and having carton receiving pockets thereon each of which is defined by a pair of spaced apart lugs, oscillating means for periodically separating at least an edge portion of the outermost carton of said stack from the remainder of said stack whereby the same may be withdrawn from said hopper, mechanism for withdrawing sequentially individual outermost cartons from said hopper and transferring the same to said conveyor; said carton transfer mechanism comprising a turret rotatable about an axis continuously and at a uniform rate timed with respect to movement of said conveyor, a plurality of carton engaging heads mounted on said turret each of which includes a suction cup for grasping a carton at said hopper and holding the same during transfer to said conveyor, drive mechanism for each suction head whereby the suction cup thereof is periodically extended and moved in a direction opposite to turret rotation as said cup is presented to said hopper then retracted to withdraw a carton and subsequently extended as said carton is presented to said conveyor, each drive mechanism presenting its respective suction cup to said hopper in a direction generally normal to the plane of the outermost collapsed carton in said stack whereby wiping motion of such cup relative to such outermost carton is precluded without altering the rate of rotation of said turret, each suction cup after withdrawal of a carton from said hopper being movable on said turret by its drive mechanism in the direction of turret rotation to overtake a leading lug of a conveyor pocket and being cooperable solely therewith in transforming the carton carried thereby to the erected condition; and means driven in timed relationship with said conveyor positioned along the path of movement of said conveyor for sequentially closing and sealing one end of each of the series of cartons in said conveyor pockets, filling the respective cartons with a predetermined amount of product, and closing and sealing the other end of each carton to retain the product therein.

3. A carton erecting, filling and sealing machine which includes a conveyor continuously movable at a predetermined uniform rate, a series of carton receiving pockets on said conveyor each of which is defined by a pair of spaced lugs one of which leads the other with respect to direction of conveyor movement; a supply hopper positioned at a hopper station adjacent said conveyor and having a stack of collapsed cartons therein, oscillatable carton separating means at a discharge end of said hopper normally engageable with the outermost carton of said stack for retaining said stack in said hopper and including a carton separating leg periodically insertable between said outermost carton and the second carton of said stack whereby said outermost carton may be separated from said stack; carton transfer mechanism positioned between said hopper discharge end and said conveyor for withdrawing individual cartons from said hopper and positioning the same successively in said conveyor pockets, said transfer mechanism comprising a continuously rotatable turret on which are mounted a series of suction heads each of which includes a suction cup intended to grasp an outermost carton from said hopper, drive mechanism for each head for extending a suction cup while moving in the direction opposite to turret travel thereby neutralizing rotational speed and presenting said suction cup to the outermost carton in a direction extending generally normal to the plane of the carton without attendant tangential wiping motion and without interrupting rotation of said turret, rotation of said turret being timed to movement of said conveyor and oscillation of the carton separating means of said hopper, said suction head drive mechanism including means for also moving the suction head in the direction of turret rotation so that a suction cup may overtake a predetermined leading pocket forming lug on said conveyor and a carton carried by said head may be urged into engagement with said lug to effect opening of such carton without requiring auxiliary means to effect such opening, said drive mechanism also including means for moving an erected carton periodically generally radially of said turret whereby said erected carton may be inserted into the conveyor pocket defined by said lug without interrupting conveyor motion; a carton end closing and sealing station positioned along the length of said conveyor, a pair of reciprocable tucker arms at such station periodically engageable with leading and trailing portions of an end of said carton for inwardly folding such end portions, and means at such station for sealing such folded carton end; a movable filled device at a filler station, said filler being movable in timed relationship with said conveyor and being adapted to meter a predetermined quantity of product into said carton without interrupting motion of said conveyor; means at a second carton end closing and sealing station for infolding the other carton end and sealing the same to retain product therein; and another conveyor at a discharge station driven in timed relationship with said first mentioned conveyor for receiving said filled and sealed carton and transporting the same from said machine.

4. A carton erecting and filling machine comprising a hopper in which a supply of collapsed cartons are retained, a conveyor moving continuously and at a uniform rate relative to said hopper, and mechanism for sequentially withdrawing individual cartons from said hopper and transferring the same to said conveyor; said mechanism comprising a turret which is continuously rotatable about an axis at a uniform rate and in the same general direction as the direction in which said conveyor is moved, and oscillatable carton engaging means carried by said turret including drive mechanism for periodically extending and retracting said carton engaging means while moving it in a direction opposite to said general direction whereby said carton engaging means will move relative to said hopper in a generally radial direction without interrupting rotation of said turret and then extending said carton engaging means while moving it in said general direction thereby to move it at a faster rate relative to said conveyor.

5. A carton erecting and filling machine comprising a hopper in which a supply of collapsed cartons are retained, a conveyor moving continuously and at a uniform rate relative to said hopper and having carton receiving pockets thereon, and mechanism for sequentially withdrawing individual cartons from said hopper and transferring the same to said conveyor pockets; said mechanism comprising a turret which is continuously rotatable about an axis at a uniform rate, and carton engaging means carried by said turret including drive mech-

anism for extending and then retracting said means while moving it in a direction opposite to turret rotation thereby presenting said means to and withdrawing it from said hopper in a direction generally normal to the plane of the outermost carton therein without interrupting rotation of said turret and in a manner so that engagement of said means with such carton is substantially free of tangential wiping motion relative thereto and then extending said means while moving it in the direction of turret rotation thereby extending it at a faster speed relative to said conveyor.

6. In a carton erecting and filling machine, carton transfer mechanism for withdrawing individual collapsed cartons from a carton supply and transferring the same to a moving conveyor, said transfer mechanism comprising a shaft, a turret continuously rotatable about said shaft, a plurality of carton engaging heads on said turret rotatable therewith, and drive mechanism for sequentially presenting each of said heads to said carton supply for withdrawing individual cartons therefrom, each of said heads being periodically reciprocable by its drive mechanism in a generally radial direction relative to said shaft as said turret rotates so that said heads are presented sequentially to said carton supply in a direction generally normal to the plane of the outermost carton of said supply without attendant tangential wiping motion relative thereto and without interrupting rotation of said turret; the drive mechanism for each head comprising upper and lower head structures, said lower structure including a pair of oppositely rotatable cranks and a lower movable platform operatively connected to said cranks, said upper head structure including an upper crank secured to one of said lower cranks for rotation thereby, and an upper movable platform operatively and pivotally connected to said upper crank and said lower movable platform, and carton engaging means mounted on said upper platform.

7. Carton transfer mechanism for withdrawing an individual collapsed carton from a stack of cartons and transferring the same to a conveyor having a carton receiving pocket thereon defined by a pair of spaced lugs one of which includes a camming surface against which a carton is engageable to effect carton erection, said mechanism comprising a turret rotatable continuously at a uniform rate about an axis, a suction head on said turret rotatable therewith, said suction head comprising a suction cup presentable by said head to said carton stack in a direction generally normal to the plane of the outermost collapsed carton of said stack and without tangential wiping motion relative thereto, and drive mechanism for periodically reciprocating said head in a generally radial direction relative to said turret axis as said turret rotates whereby said suction cup may be extended and retracted at predetermined locations spaced around said axis so that said outermost carton may be withdrawn from said stack, rotated with said head on said turret toward said conveyor and moved into engagement with the camming surface of said one lug of said pocket to effect erection of said carton without requiring auxiliary carton erecting means; said suction head drive mechanism comprising an upper platform on which said suction cup is mounted and a lower platform, one of said platforms including a slidable block mounted on a guide rod thereof, a rotatable crank positioned between said platforms and pivotally engaged with said slidable block, means swingably connecting said platforms adjacent ends thereof, and means for effecting rotation of said crank whereby the direction in which the center line of said upper platform extends may be varied upon rotation of said crank relative to the direction in which the center line of said lower platform extends so that said suction cup may be presented to said stack of cartons in said generally normal direction upon reciprocation of said suction cup to its fully extended position.

8. Drive mechanism for a movable suction head for reciprocating the head periodically relative to an axis as the head is continuously rotated about such axis, comprising a non-rotatable sun gear, a first pinion gear meshed with said sun gear and a second pinion gear meshed with said first pinion gear, means for rotating said pinion gears in unison around said sun gear while said pinion gears at the same time are rotated about their respective axes in opposite directions, first and second cranks connected with said first and second pinion gears and oppositely rotatable therewith, a lower mounting platform comprising front and rear blocks and a guide rod extending therebetween, said rear block being pivotally connected to said first crank, a slidable block movably mounted on said guide rod and pivotally connected to said second crank, rotation of said cranks in opposite directions resulting in periodic in and out oscillation of said platform relative to said axis, and means operatively connected with said lower platform for mounting a suction cup for oscillation therewith.

9. Drive mechanism for a movable suction head for reciprocating the head relative to an axis as the head is continuously rotated about such axis, comprising a non-rotatable sun gear, a first pinion gear meshed with said sun gear and a second pinion gear meshed with said first pinion gear, means for rotating said pinion gears in unison around said sun gear while said pinion gears at the same time are rotated about their respective axes in opposite directions, first and second cranks connected with said first and second pinion gears and oppositely rotatable therewith, a lower mounting platform comprising front and rear blocks and a guide rod extending therebetween, said rear block being pivotally connected to said first crank, a slidable block movably mounted on said guide rod and pivotally connected to said second crank, rotation of said cranks in opposite directions resulting in periodic in and out oscillation of said platform relative to said axis; and means operatively connected with said lower platform for mounting a suction cup for oscillation therewith, said suction cup mounting means comprising an upper platform including a guide rod adjacent one end of which a fixed block is mounted, a slidable block movably mounted on said last mentioned guide rod, an upper crank secured to said first crank for continuous rotation therewith interposed between said upper and lower platforms and pivotally engaged with said slidable block of said upper platform, and a pivotal connection between said fixed block of said upper platform and said front block of said lower platform; oscillation of said lower platform and said upper crank upon opposite rotation of said first and second cranks producing attendant oscillation of said upper platform.

10. Carton transfer mechanism for withdrawing individual cartons from a supply hopper and presenting the same to a conveyor comprising a turret rotatable about an axis, a plurality of suction heads rotatable with said turret, first and second vacuum control discs mounted adjacent said turret, the first of said discs being non-rotatable and connected to a vacuum source, the second of said discs being rotatable with said turret and relative to said first disc, a vacuum control channel in said first disc connected with said vacuum source, and a plurality of vacuum passages in said second disc equal in number to the number of suction beads on said turret, a suction head being operatively connected to a respective vacuum passage whereby suction may be applied to the respective heads in a controlled manner, rotation of said discs relative to each other resulting in application of suction to a given suction head as the vacuum passage to which it is connected is periodically aligned with said vacuum control channel, and cut-off means in the end of said vacuum control channel first traversed by said vacuum passages movable to cover the vacuum passages as the same are rotated past said channel whereby application of vacuum to said suction heads may be cut off as desired without interrupting rotation of said turret.

11. The vacuum control means of claim 10 in which said control channel is of arcuate configuration, the cen-

ter line of said arcuate control channel and the centers of said vacuum passages in said other disc being spaced approximately equal distances from the axis of said hollow shaft.

12. In a carton erecting and filling machine for transforming a carton from the collapsed state to the erected state; such carton in the erected state comprising opposite side walls and end walls, closure flaps hingedly connected to said side walls and closure tabs hingedly connected to said end walls at an open end of the carton; a conveyor for transporting said carton along a given path parallel to said side walls, and means for closing an end of said carton as the same is moved by said conveyor comprising a pair of arms mounted adjacent said conveyor for reciprocation into and out of the path traversed by said closure tabs for engaging the closure tabs of said carton and for folding the same inwardly toward each other, each of said arms being oscillatable toward a respective closure tab to fold the same inwardly and oscillatably away from such tab after folding and after reciprocating out of the path traversed by said carton tabs, said arms being movable in timed relation with movement of said conveyor whereby said arms may be employed to fold the closure tabs of a series of successive cartons carried by said conveyor, and a plow device which converges in the direction of movement of said conveyor for retaining the closure tabs of each such carton in the folded position and for positioning the closure flaps at an end of each such carton to overlie the tabs thereof preparatory to sealing such end.

13. A carton erecting and filling machine for transforming a carton from the collapsed state to the erected state and for sealing and filling the same with product; such carton in the erected state comprising opposite side walls and end walls, a closure flap hingedly connected to each of said side walls, a closure tab hingedly connected to each of said end walls intermediate said side walls, and a tubular carton liner having a sealable inner surface positioned within said carton walls, said liner extending longitudinally beyond said walls and being adhesively secured to said closure flaps; a conveyor for transporting said carton along a given path parallel to said side walls, and means for closing an end of said carton as the same is moved therepast by said conveyor comprising a pair of reciprocating arms mounted adjacent said conveyor for alternate extension and retraction into and out of the path traversed by closure tabs of cartons moving along said conveyor, one of said arms being movable into periodic engagement with the leading closure tab at said carton end and the other of said arms being oscillatable during extension thereof in the direction of carton movement into periodic engagement with the trailing closure tab at said carton end, said closure tabs being foldable by said arms inwardly toward each other thereby imparting a gusset type fold to the end of said carton liner, and mechanism for reciprocating said arms with a scissors-type motion in timed relationship to each other and to movement of said carton transported by said conveyor therepast.

14. In a carton erecting and filling machine, reciprocating means for closing an end of a carton transported therepast, comprising a pair of oscillatable tucker arms, one of said arms being movable into the path of a moving carton and engageable therewith to infold a leading portion of said carton, the other of said arms being movable in eccentric fashion to overtake from the rear and infold a trailing portion of said carton toward the infolded leading portion, said arms being reciprocable relative to said moving carton for engaging the same and also being reciprocable in scissors fashion relative to each other whereby said other arm may be moved into overtaking relationship with the carton trailing portion, and drive means for reciprocating said arms in timed relationship with movement of said carton whereby interruption of movement of said carton during end closing is precluded, said drive means comprising a continuously rotatable crank operatively connected to an end of each arm whereby rotation of said crank produces alternate back and forth movement of said arms relative to said carton, each of said arms being provided with a cam slot engageable with a cam guide extending therethrough, the cam slot in said one arm being generally straight and the cam slot in said other arm being arcuate whereby rotation of said crank produces eccentric reciprocation of said arms relative to each other thereby imparting said scissors type movement to said arms.

15. Conveyor construction for transporting cartons in a carton erecting and filling machine after such cartons have been presented thereto by carton transfer mechanism traveling an arcuate path to a point of substantial tangency therewith, comprising an endless conveyor belt continuously movable at a uniform rate over a pair of spaced conveyor sprockets, and a series of carton receiving pockets spaced along said belt, opposite walls of each of said pockets being defined by a pair of spaced lugs projecting from said belt and movable therewith, one lug of each pocket being positioned in leading relationship relative to the direction of movement of said belt, said one leading lug being substantially longer than the other lug of the pocket and projecting laterally beyond said other lug thereby providing a camming surface against which a leading edge of a substantially collapsed carton carried by said transfer mechanism may be engaged prior to reaching said point of substantial tangency to effect erection of said carton without requiring use of auxiliary means engageable with said carton to effect carton erection, the erected carton being slidable over said leading lug fully into said pocket by said transfer mechanism substantially as it reaches said point of substantial tangency, said other lug of each pocket including means for engaging a trailing portion of the erected carton for maintaining the same in a conveyor pocket and precluding subsequent collapse thereof.

16. A method of transforming a carton from the collapsed state to the erected state comprising providing movable suction means for grasping a collapsed carton by a wall thereof, providing an abutment against which said carton is to be engaged, moving said abutment continuously and at a uniform rate, moving said suction means with said carton grasped thereby in the same general direction as that in which said abutment is moved at a faster rate of speed than said abutment until an edge of said carton which leads during movement of said carton overtakes and strikes said abutment, and slowing movement of said suction means to the speed of said abutment as said carton is fully erected against said abutment whereby erection of said carton is effected without requiring engagement with said carton of any mechanism in addition to said suction means and said abutment.

17. A method of erecting a collapsed carton and inserting the same into a moving carton receiving pocket comprising grasping a carton from a supply of similar cartons, providing a carton receiving pocket defined by spaced walls, moving said pocket in a fixed path and at a predetermined rate, moving said carton in a generally circular direction relative to an axis toward said moving pocket faster than said predetermined rate, engaging a leading edge of said carton with a pocket wall, gradually slowing movement of said carton to the speed of said pocket wall until said carton is erected, and moving the erected carton generally radially of said axis into said pocket, and releasing said erected carton to said pocket.

18. A method of erecting, filling and sealing a carton which includes opposite side walls and opposite end walls with one side wall and one end wall making up each half of the carton when collapsed, a sealable tubular carton liner positioned between opposite halves of the collapsed carton and extending longitudinally beyond the walls thereof, closure flaps hingedly connected to said opposite side walls and closure tabs hingedly connected to said opposite end walls at opposite longitudinal ends of said car-

ton, said method comprising providing a supply of collapsed cartons at a first station, separating and withdrawing the outermost carton of said supply in a direction generally normal to the plane of said outermost carton by applying suction to a side wall thereof, transferring said separated carton along a fixed path and in a continuous manner to a second station, at said second station providing a pair of spaced pocket forming lugs, moving said lugs continuously and at a uniform rate past such second station, moving said carton faster than said lugs and in the same general direction as said lugs until a leading carton edge engages the leading one of said lugs, slowing movement of said carton relative to said leading lug until it reaches the speed thereof when said carton is fully erected with open carton longitudinal ends, positioning said erected carton between said lugs and cutting off the suction so that said carton thereafter is carried by said lugs, moving said lugs and said carton therebetween past a third station, at said third station closing one carton longitudinal end by sequentially folding opposite closure tabs inwardly toward each other and folding closure flaps over said closure tabs thereby providing gusset folds in said liner and bringing opposite walls of said liner into substantial face to face engagement to provide a closed carton extremity, moving said carton past a fourth station, sealing said carton extremity at said fourth station, moving said carton past a fifth station, at said fifth station metering a predetermined quanity of product into said carton, moving said carton past seventh and eighth stations, closing and sealing the other longitudinal end of the filled carton at said seventh and eighth stations respectively thereby providing another sealed carton extremity, and separating said filled and sealed carton from said lugs at a ninth station.

19. Carton transfer mechanism for withdrawing an individual collapsed carton from a stack of cartons and transferring the same to a moving conveyor comprising:

a turret rotatable at a constant rate about an axis,

a first platform pivotally mounted on said turret,

a continuous motion crank drive operatively sequentially extending and retracting said first platform relative to said axis while alternately swinging the outer end of said first platform in opposite generally circumferential directions,

a second platform pivotally mounted at the outer end thereof on the outer end of said first platform,

compensating means alternately pivoting the inner end of said second platform in the same generally circumferential direction as the outer end of said first platform so that said second platform remains disposed parallel to radii of said turret, and

a suction head carried on the outer end of said second platform.

20. Carton transfer mechanism for withdrawing an individual collapsed carton from a stack of cartons and transferring the same to a moving conveyor comprising:

a turret rotatable at a constant rate about an axis,

a first platform on said turret,

a continuous motion crank drive operatively sequentially extending said lower platform toward said stack of cartons while swinging the outer end of said lower platform in a direction opposite to rotation of said turret, retracting said lower platform and then extending said lower platform as said turret rotates toward said conveyor,

an upper platform pivotally mounted at the outer end thereof on the outer end of said lower platform,

a suction head carried on the outer end of said upper platform, and

compensating means swinging the inner end of said upper platform in the same direction as the outer end of said lower platform to maintain said upper platform disposed parallel to a radius of said turret passing through the pivot of said lower platform.

21. A carton erecting and filling machine comprising a conveyor for transporting a series of cartons at a constant rate with leading and trailing flap members extending therefrom, and

means for folding said flap members comprising

a pair of tucker arms,

a rotatable crank to which an end of each arm is operatively connected so that rotation of said crank alternately extends and retracts the other ends of said arms into and out of the path traversed by said flap members, and

guide means associated with one of said arms constraining movement of the other end thereof as it is extended along a forward path to overtake and fold a trailing flap member and then to be retracted out of the path of the leading flap member of a succeeding carton.

References Cited in the file of this patent

UNITED STATES PATENTS

1,570,848	Lloyd	Jan. 26, 1926
2,136,901	Ferguson	Nov. 15, 1938
2,289,820	Ardell	July 14, 1942
2,318,208	First et al.	May 4, 1943
2,441,372	Quigley et al.	May 11, 1948
2,620,961	Wahl et al.	Dec. 9, 1952
2,623,233	Maier et al.	Dec. 30, 1952
2,643,497	Woelfer	June 30, 1953
2,665,044	Monroe et al.	Jan. 5, 1954
2,671,240	Bowman et al.	Mar. 9, 1954
2,732,987	Moore	Jan. 31, 1956
2,736,998	Walrave et al.	Mar. 6, 1956
2,757,498	Meyer-Jagenberg et al.	Apr. 7, 1956
2,746,363	Anderson	May 22, 1956
2,762,274	Kerr	Sept. 11, 1956
2,799,128	Koons	July 16, 1957
2,831,407	Pittman et al.	Apr. 22, 1958
2,840,375	Kerr et al.	June 24, 1958
2,847,213	Duncanson et al.	Aug. 12, 1958
2,851,837	Ardell et al.	Sept. 16, 1958
2,936,681	Earp	May 17, 1960