Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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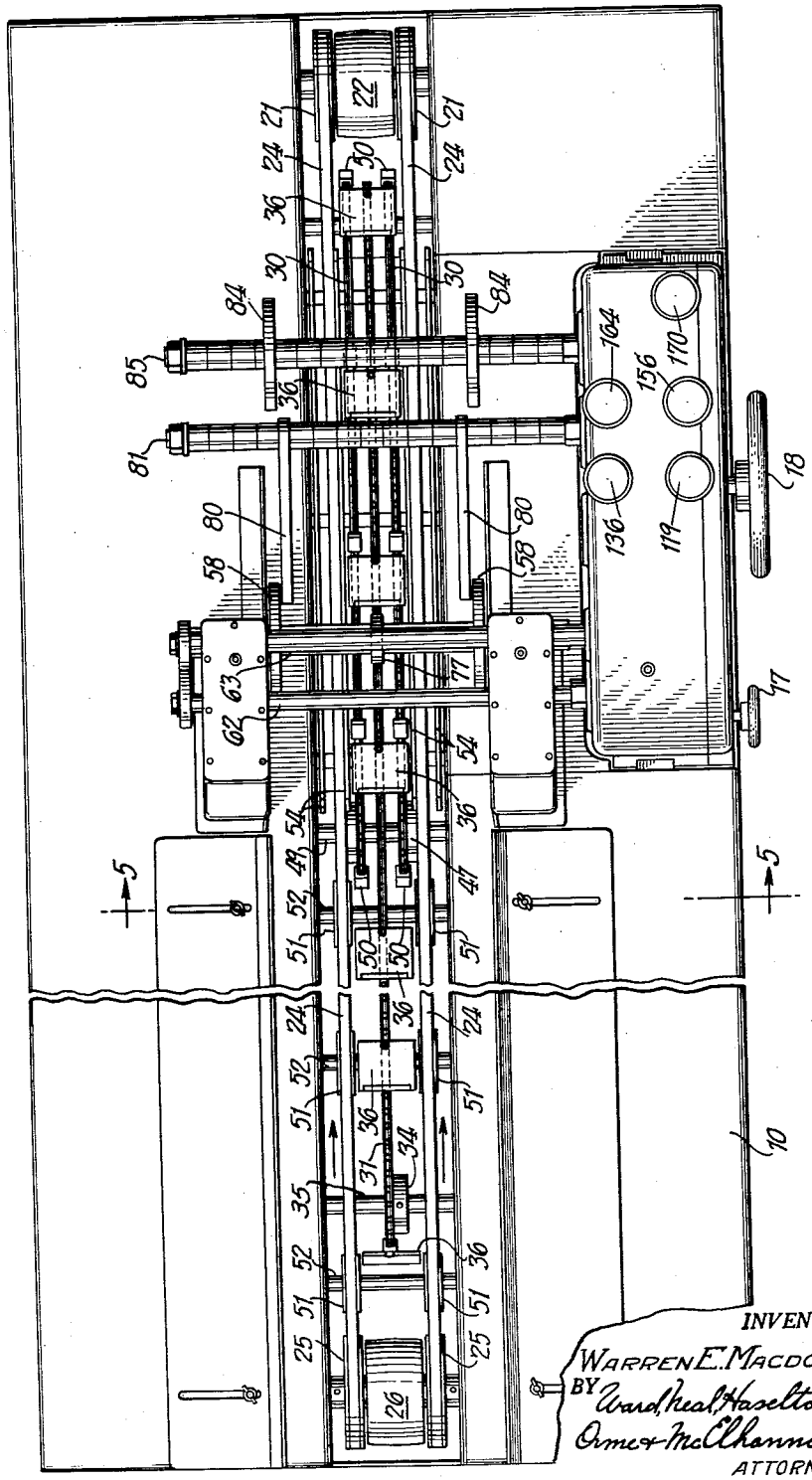


Fig. 1.

INVENTOR.
WARREN E. MACDONALD.
BY Ward, Neal, Haselton
Omer & McElhannon
ATTORNEYS.

Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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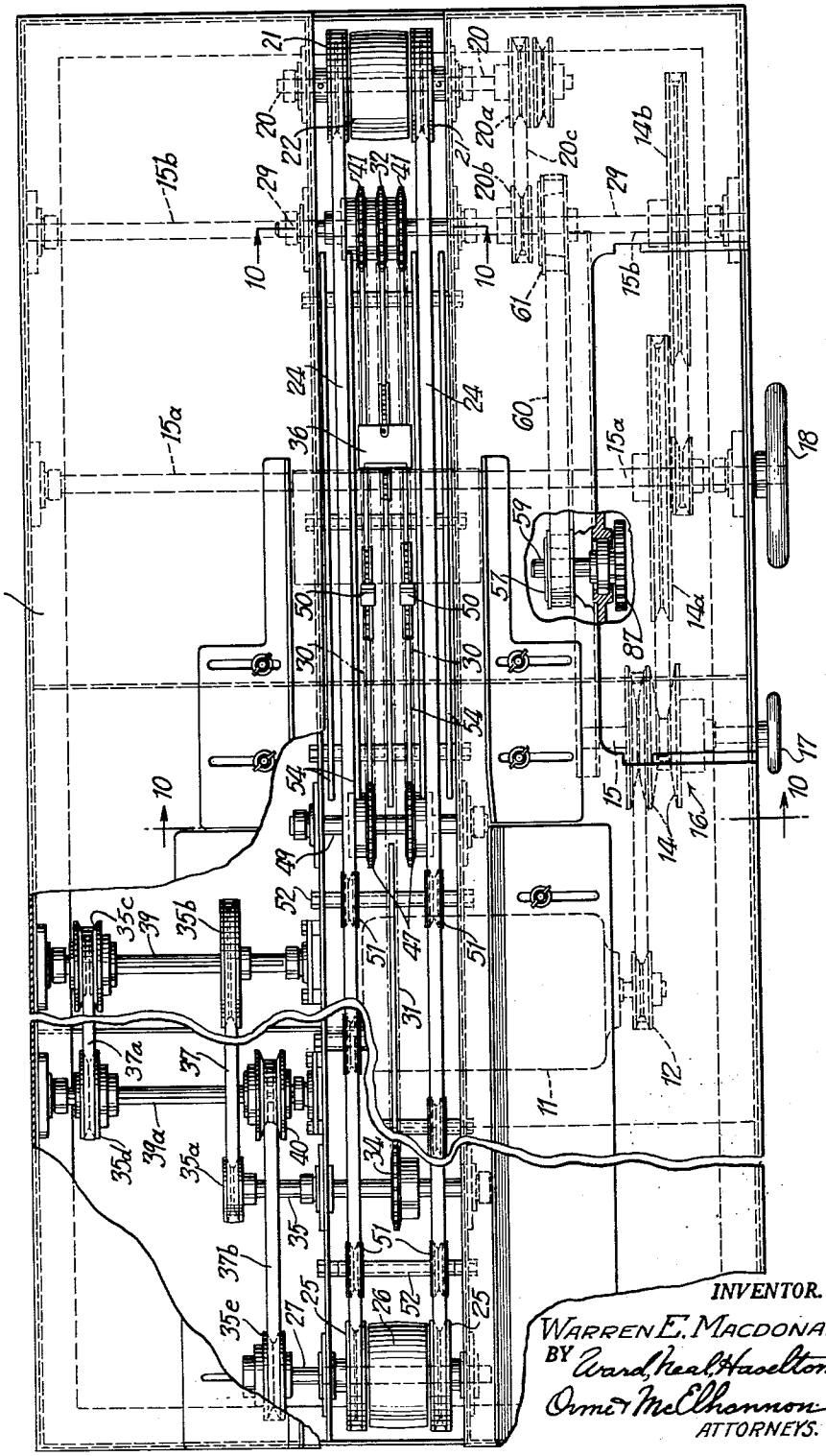


Fig. 2.

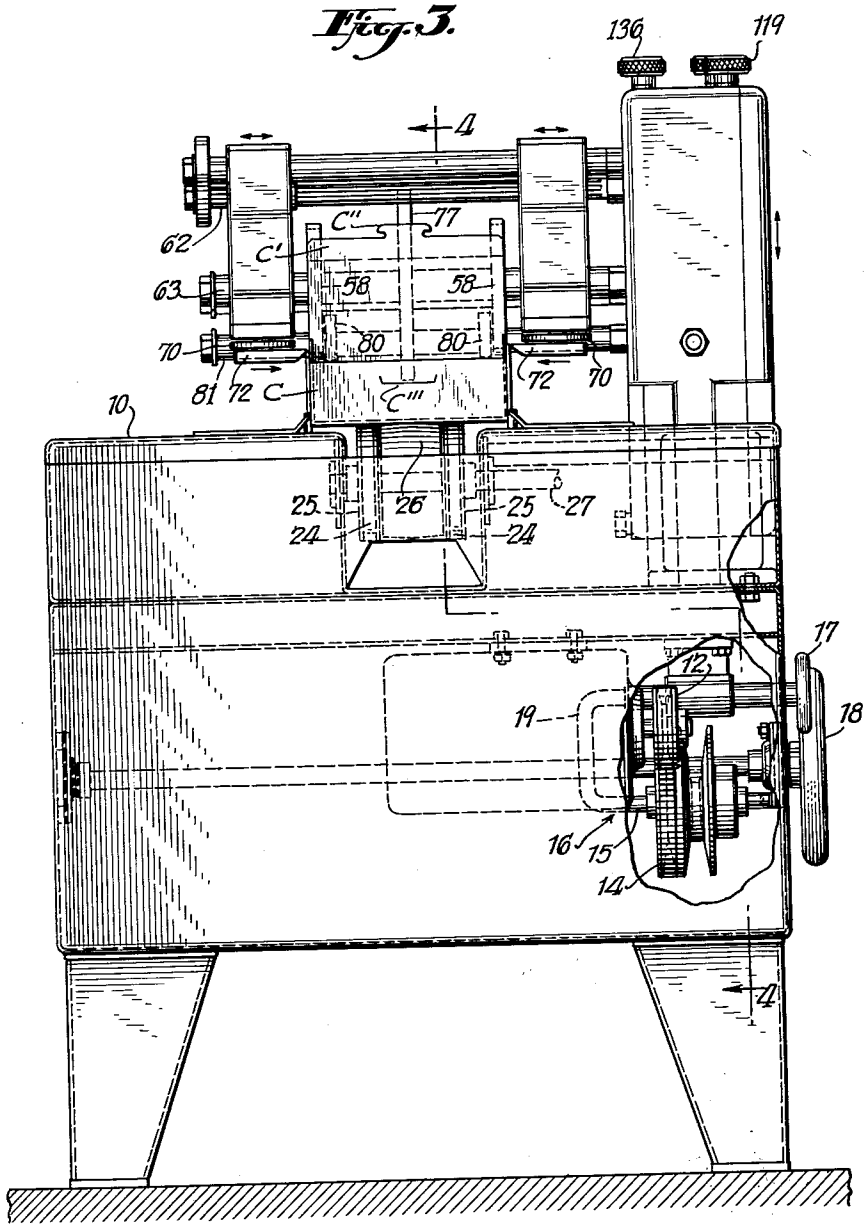
INVENTOR.
WARREN E. MACDONALD.
BY Ward, Neal, Haselton, Ormet & McElhannon
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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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Fig. 3.



INVENTOR.
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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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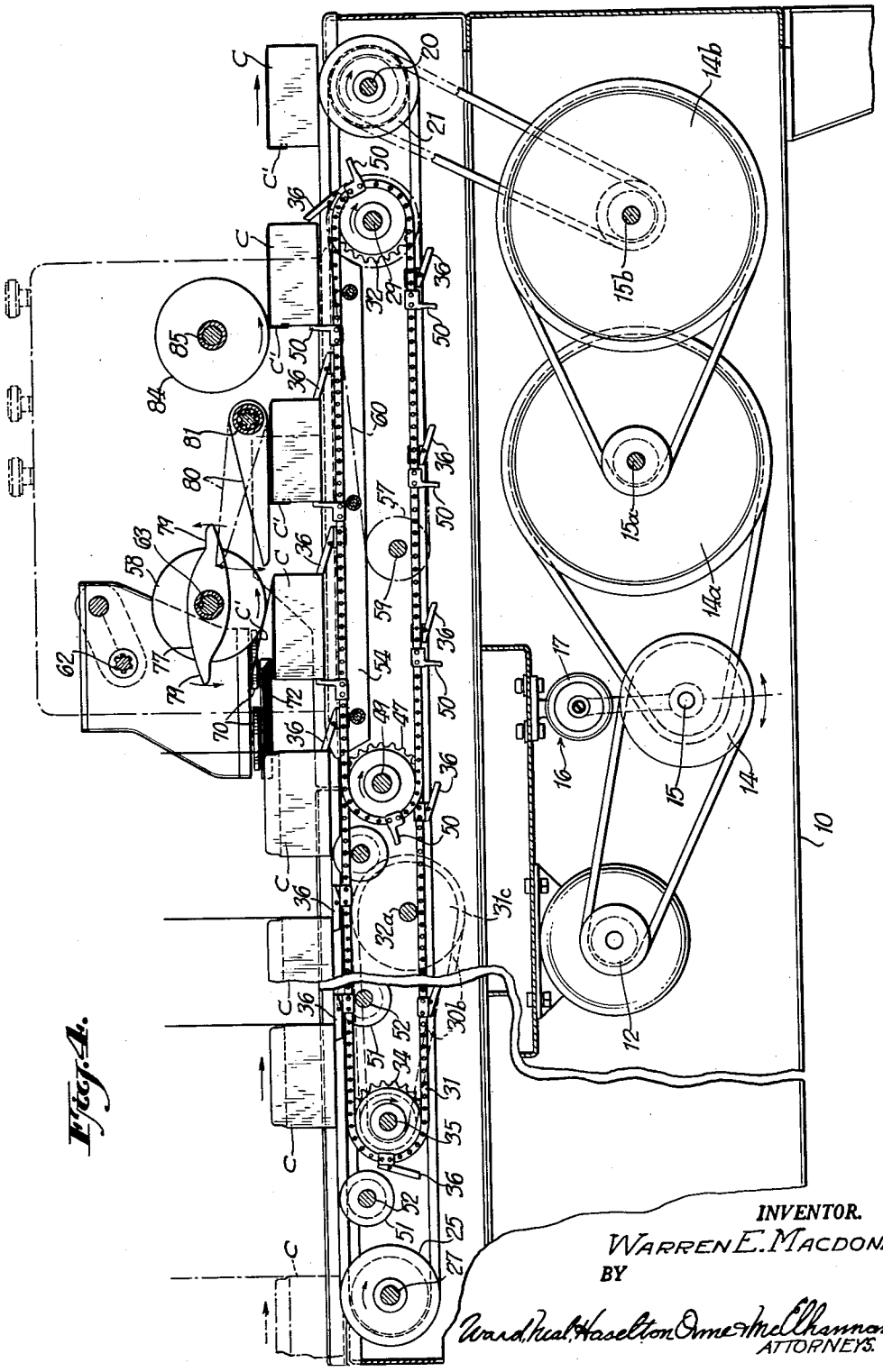


Fig. 4.

INVENTOR.
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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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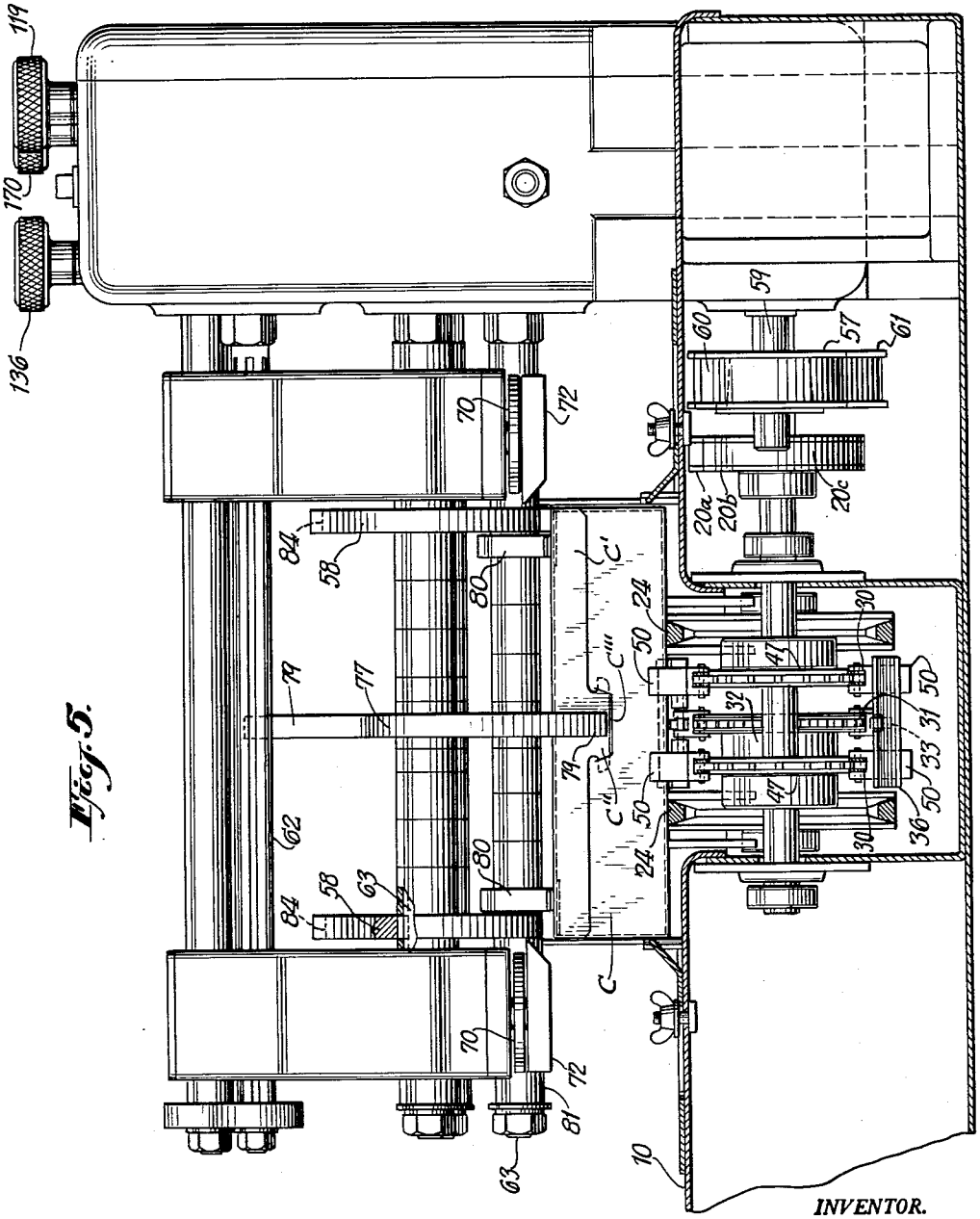


Fig. 5.

INVENTOR.

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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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Fig. 6.

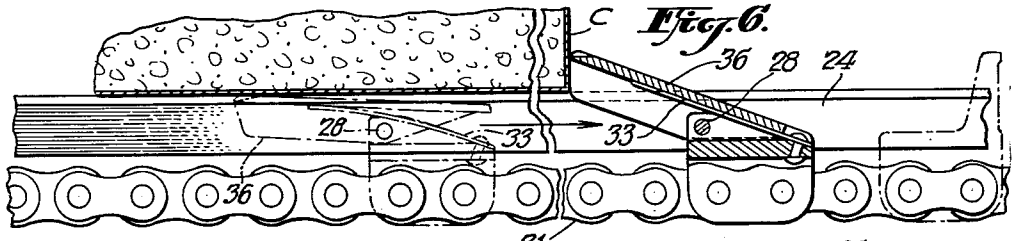


Fig. 7.

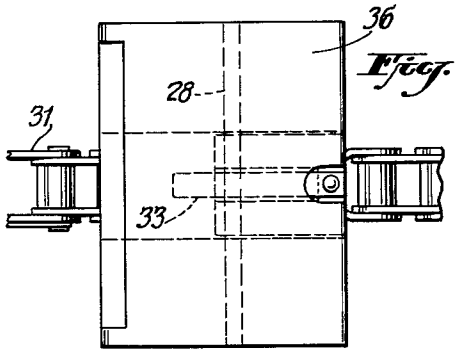


Fig. 8.

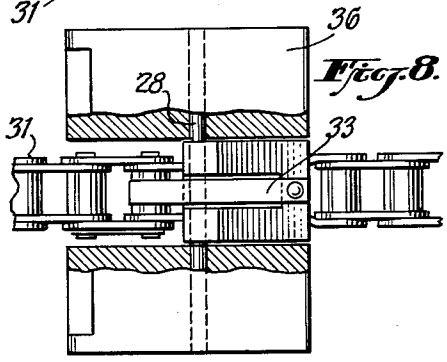
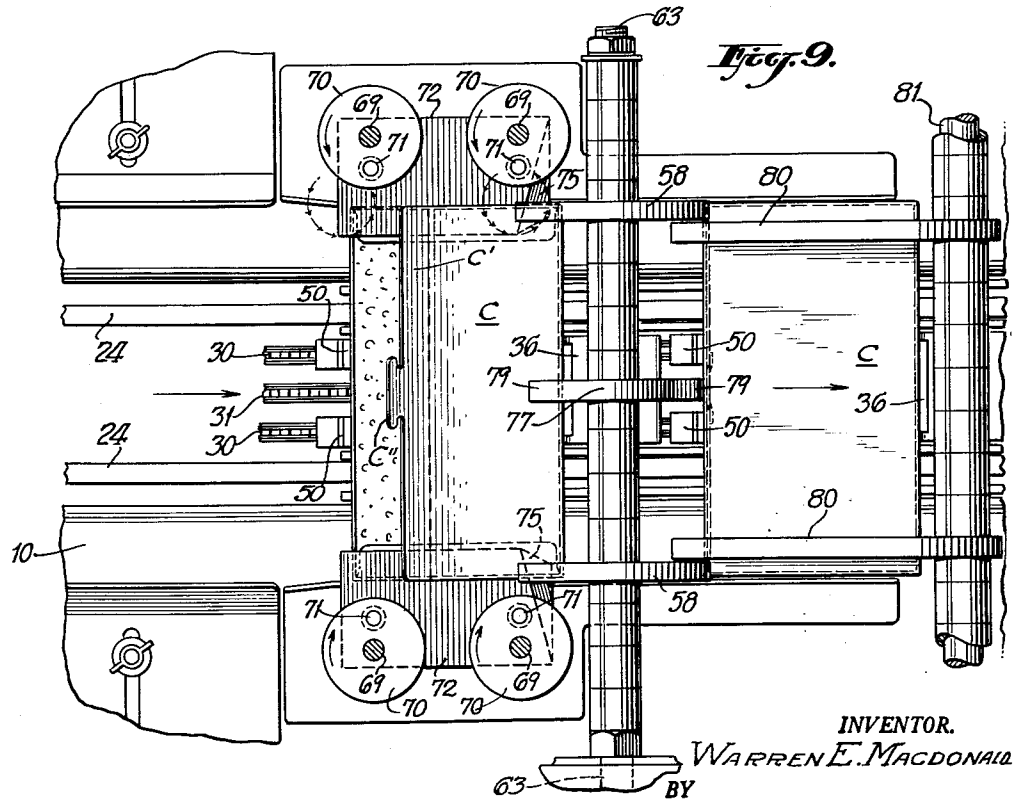


Fig. 9.



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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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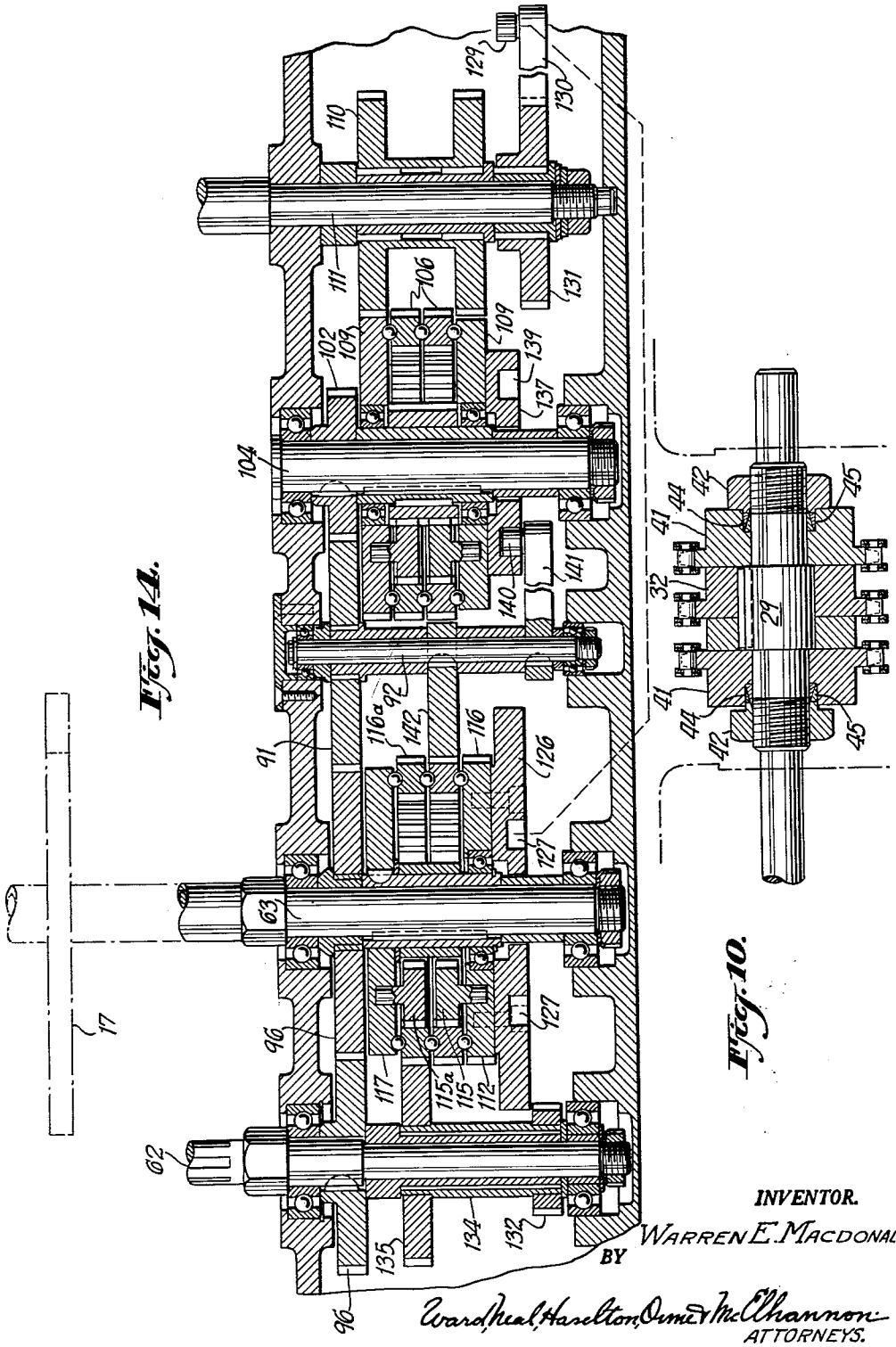


Fig. 14.

Fig. 10.

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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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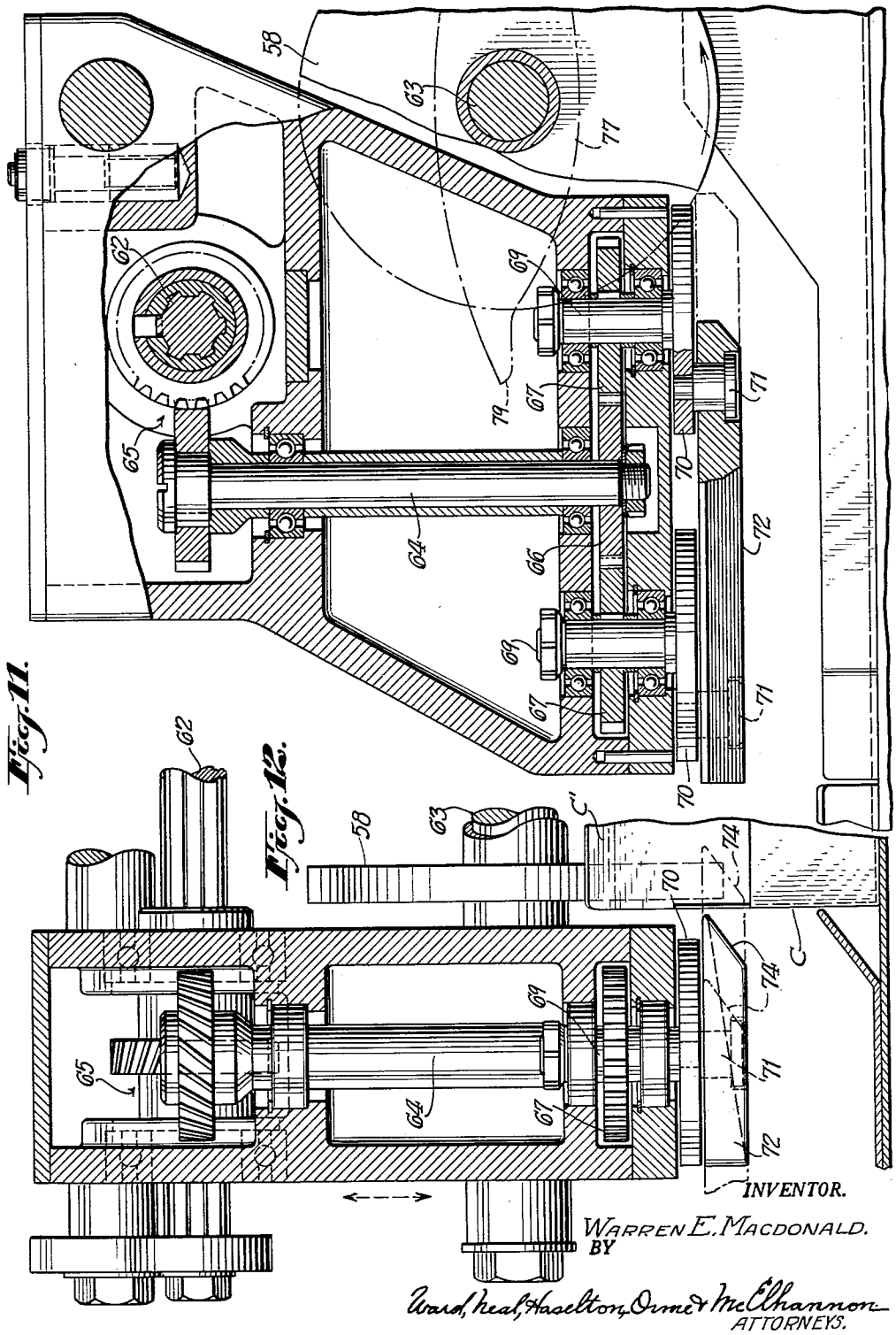


Fig. 11.

Fig. 12.

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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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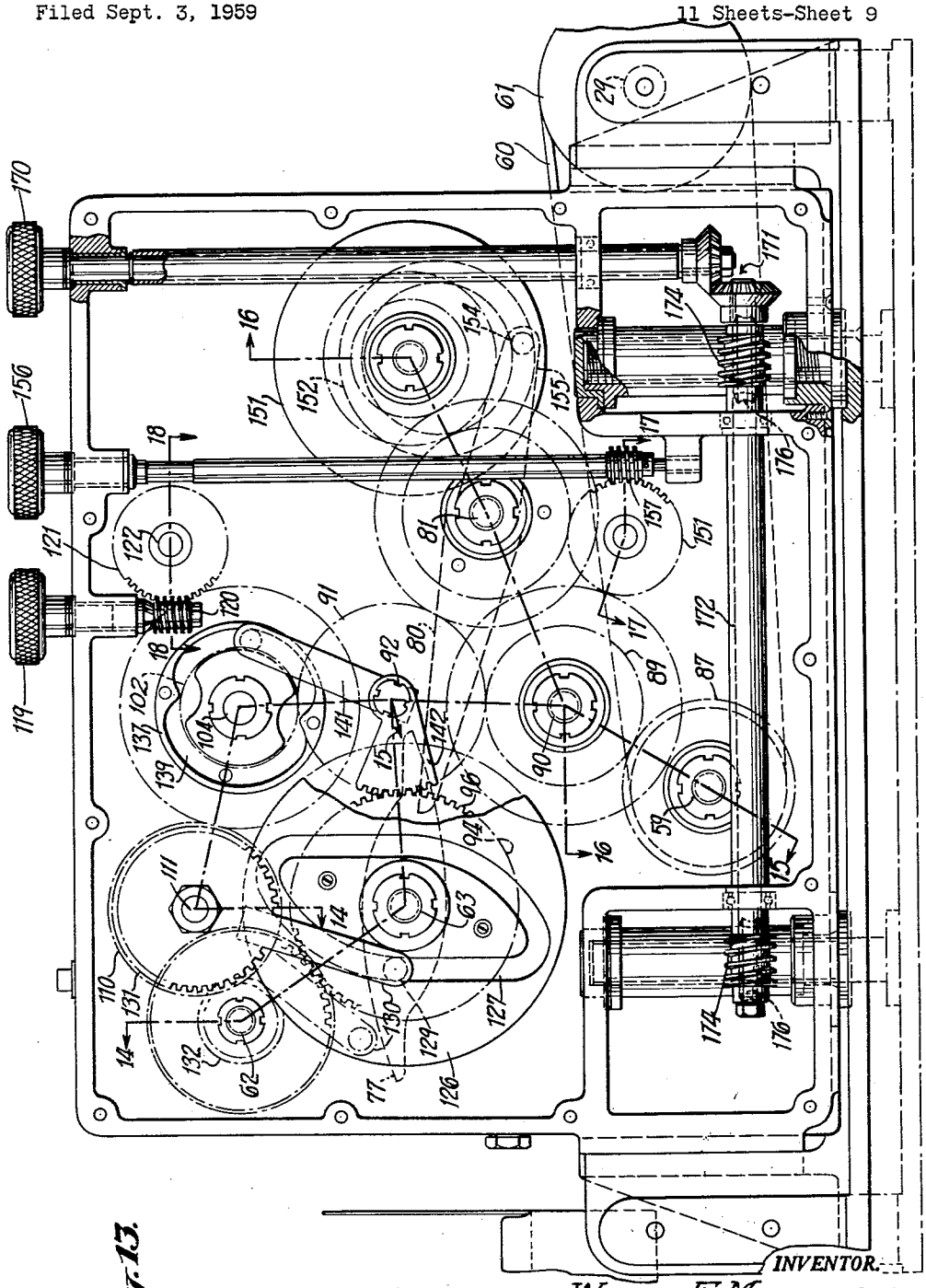


Fig. 13.

INVENTOR.
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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

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Fig. 15.

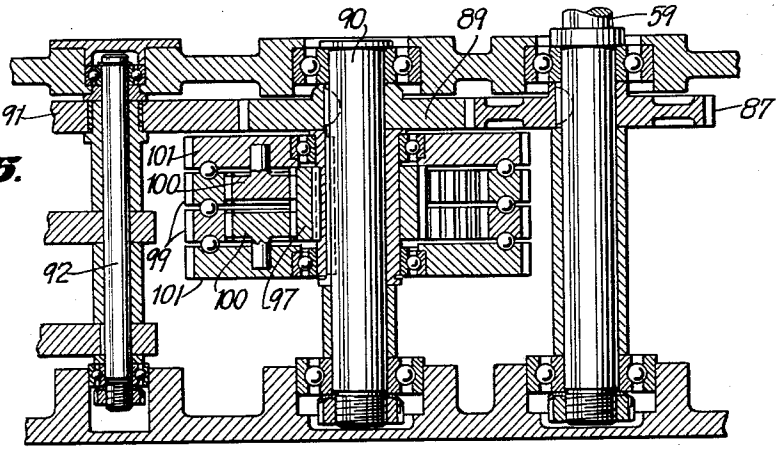


Fig. 16.

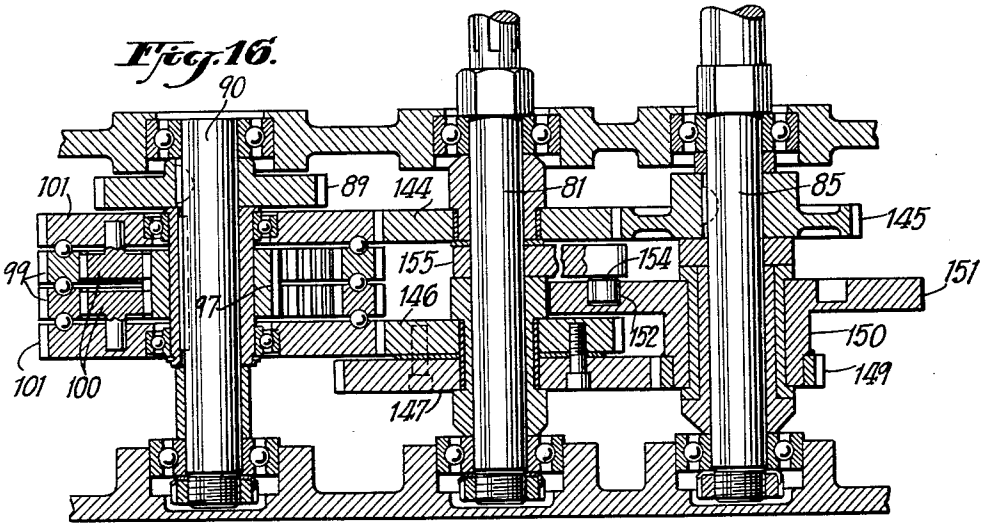


Fig. 17.

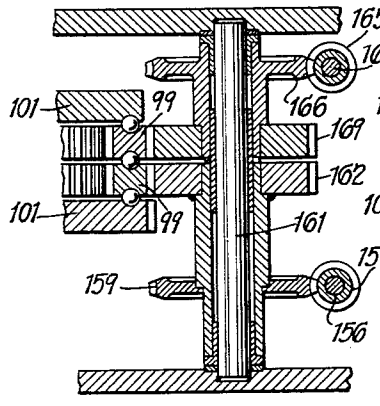
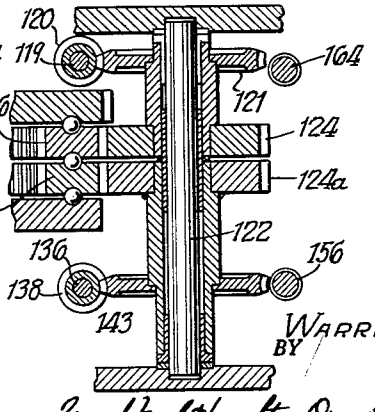


Fig. 18.



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Jan. 9, 1962 W. E. MacDONALD 3,015,919

CARTON CLOSING MACHINE

Filed Sept. 3, 1959 11 Sheets-Sheet 11

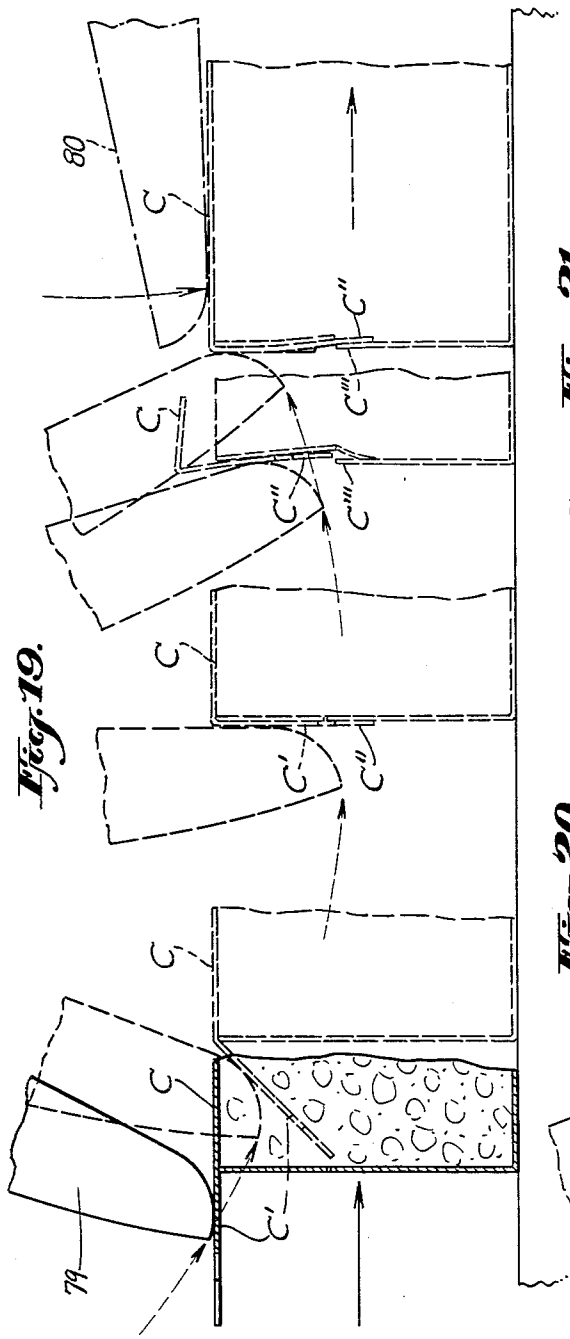


Fig. 19.

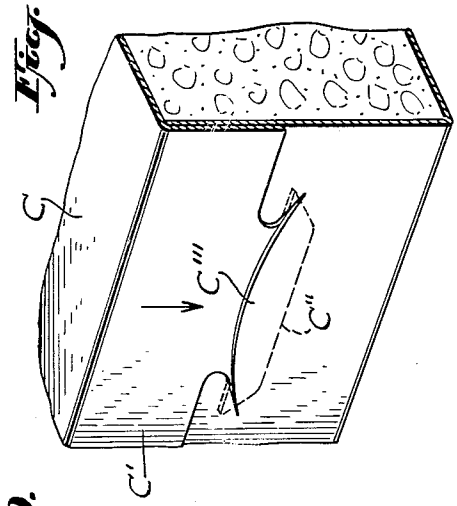


Fig. 21.

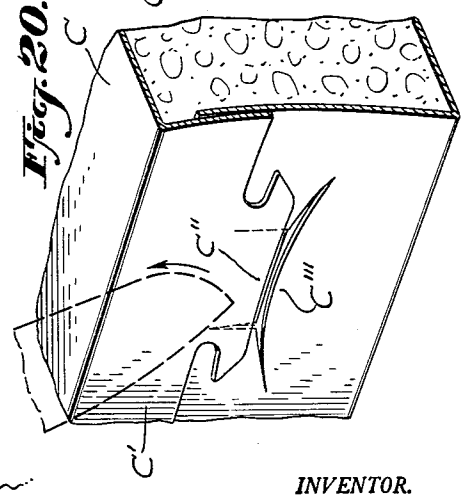


Fig. 20.

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Ward, Neal, Haselton, Ormet & McChannon.
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United States Patent Office 3,015,919 Patented Jan. 9, 1962

3,015,919

CARTON CLOSING MACHINE

Warren E. MacDonald, Barrington, R.I., assignor to St. Regis Paper Company, New York, N.Y., a corporation of New York

Filed Sept. 3, 1959, Ser. No. 837,822
22 Claims. (Cl. 53—38)

This invention relates to carton closing machines and, more particularly, to such machines for closing paper board cartons of the type which may have dust flaps, a lid and a front lid flap which may be locked by means of one or several locking tongues, to the face of the carton or by tucking the front lid flap inside the front face of the carton as the cartons move through the machine. Such cartons are frequently used, for example, in the packaging of frozen foods.

Heretofore, carton closing machines of the class described have often been so constructed as to raise or lower the cartons on their excursion through the machine for the performance of various operations thereon, or have utilized a gating mechanism for feeding the open, filled cartons to the closing elements in order to assure movement of the cartons through the machine in proper spaced disposition. Frequently too, the filled cartons were moved step by step or intermittently through the machine. It will be understood by those persons skilled in the art that constructions necessitating such operations are inherently relatively slow acting since the material being packaged must be handled gently and starting and stopping or changing direction exerts forces upon such material which, if not kept to a minimum, will damage same or even eject it from the carton.

Accordingly, the present invention contemplates a carton closing machine in which the filled cartons are carried through the machine with a continuous movement and without changing direction, thus enabling the cartons to be moved at relatively high speed without damage to the contents thereof and without spillage.

In essence, there are provided by the present invention means for timing the cartons through the machine, means for folding the dust flaps and means for closing and locking the cover, all while the cartons move at a substantially uniform, relatively high speed. Actually, the speed of movement of the cartons does change slightly during their excursion through the machine, but since the speed changes are so slight as to eliminate the possibility of damage to or spillage of the contents thereof, the speed may be considered as being substantially uniform for present purposes.

As a feature of the invention, means are provided for receiving the filled, open cartons from a full line or a random feed line and for spacing the cartons so that they will be in timed relation to the closing elements of the machine

A further feature of the invention contemplates the utilization of plates mounted to rotate in an orbital path in time with the cartons so as to engage and fold the dust flaps as the cartons pass between the plates. The orbital path of these plates is such that they move inwardly and forwardly with each carton, thereby folding the flaps inwardly, and then move outwardly of the cartons and return to position to act upon the next carton. It will be appreciated that by so moving these plates, the dust flaps may be folded without the plates interfering with the open lid of the carton even though the carton continues to move through the machine, thus obviating the need to stop the carton while the flaps are folded.

As the dust flap folding plates move outwardly away from the cartons, the cartons reach means which bend the covers downwardly thus securing the dust flaps in position. Preferably, the bending means take the form of

rollers which rotate so as to maintain a surface speed equal to the speed of the carton, although they could very well be stationary.

As a particular feature of the present invention, there is provided one or more lid flap fingers which, when the lid is flat, contacts the lid flap, or cover flap, and bends it into depending position, pressing it against the face of the carton. Since this finger rotates about an axis common to the axis of rotation of the lid closing rollers, but is somewhat longer, it will be understood that its remote end moves somewhat faster than the roller surface speed so that it would ordinarily tend to push against the lid flap. Accordingly, means are provided for reducing the speed of rotation of the finger at precisely the time when this tendency begins to occur so that its horizontal component of movement is equal to the speed of the carton so as to prevent injury to the carton. As the end of the finger travels along with the box, it, of course, has a vertical component giving it a wiping action relatively to the depending lid flap, thus lifting it and the locking tongue provided thereon to a level above a corresponding locking slot in the face of the carton, or lifting it to a level above the top of the front face of the carton in instances where the machine is adjusted to tuck the lid flap into the box directly behind the front face of the carton. At this stage of the closing operation, another driving input is superimposed upon the movement of the finger to increase its speed of rotation and therefore its horizontal component, thus causing its end to overrun the lid flap to depress it, and in the case of the locking tongue, the face of the carton is also thereby depressed, thus opening the locking slot, as the locking tongue is positioned above the slot. It will be understood, therefore, that the finger utilizes a variable angular velocity to obtain a uniform linear velocity of one of the vector components, that is, its horizontal component, during a portion of its rotating cycle, after which its angular velocity, and thus the velocity of its horizontal component, is accelerated to cause the finger to overrun the carton. Should the carton be of the type which utilizes several locking tongues and corresponding slits, say one set at each side edge of the lid flap and front face, respectively, then, of course, a corresponding number of fingers may also be used.

As the carton continues to advance through the machine, rocker arms, rocking in vertical planes with a light motion press the lid downwardly and cause the locking tongue to engage its corresponding slot in the carton face to lock the lid in closed position. In the adjusted operation where the lid flap is raised above the front face, that is when the timed angular acceleration of the fingers to overrun the carton is delayed and likewise the downwardly motion of the rocker arms is delayed, the lid flap is moved downwardly into the box behind the front face of the carton to form a "tuck" closure.

The machine preferably includes auxiliary rolls for depressing the marginal edge portions of the lid to effect interlocking of the lid and the dust flaps where the side edges of the lid are formed with tongues and the dust flaps are formed with corresponding slots beneath such marginal edge portions. Such cartons are described in copending application of Leslie W. Cline and Warren E. Macdonald, Serial No. 786,730, filed January 14, 1959. These auxiliary rolls may also conveniently be utilized to apply a code or legend, for example, to the carton surface; and it is preferred that they rotate with a surface speed equal to that of the cartons.

The feeding, timing, conveying, holding, and closing elements of the machine are also adjustable so as to enable the machine to close cartons having different dimensions, configurations, and styles.

These has thus been outlined rather broadly the more important features of the present invention in order that

the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which the present disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of the invention. It is important, therefore, that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope of the invention, in order to prevent the appropriation of the invention by those skilled in the art.

A specific embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification wherein:

FIG. 1 is a fragmentary top plan view of a machine in accordance with the present invention;

FIG. 2 is a view similar to FIG. 1 but with certain parts broken away to show various operating members of the machine;

FIG. 3 is an end view, partly broken away to illustrate various interior parts;

FIG. 4 is a cross-sectional view taken along the lines **4—4** of FIG. 3;

FIG. 5 is a cross-sectional view taken along the lines **5—5** of FIG. 1;

FIG. 6 is a fragmentary elevational view, partly in cross-section, illustrating an abutment or flapper member for controlling the position of the cartons moving through the machine, the abutment member being shown in broken lines in position beneath the carton and in solid lines abutting the leading surface of the carton;

FIG. 7 is a top plan view of a flapper member;

FIG. 8 is a view similar to FIG. 7 but partly broken away;

FIG. 9 is a partial top plan view illustrating certain of the closing elements in relation to cartons passing through the machine;

FIG. 10 is a cross-sectional view taken along the lines **10—10** of FIG. 2;

FIG. 11 is a side elevational view, partly broken away, illustrating certain parts of the dust flap bending elements;

FIG. 12 is a cross-sectional view taken along the lines **12—12** of FIG. 11;

FIG. 13 is an elevational view, partly broken away, illustrating part of the closing head for controlling the closing elements;

FIG. 14 is a cross-sectional view taken along the lines **14—14** of FIG. 13.

FIG. 15 is a cross-sectional view taken along the lines **15—15** of FIG. 13;

FIG. 16 is a cross-sectional view taken along the lines **16—16** of FIG. 13;

FIG. 17 is a cross-sectional view taken along the lines **17—17** of FIG. 13;

FIG. 18 is a cross-sectional view taken along the lines **18—18** of FIG. 13;

FIG. 19 is a fragmentary view of a carton in several positions and being acted upon by various closing elements;

FIG. 20 is a perspective view showing the carton lid flap and front slot in the course of being locked together; and

FIG. 21 is a view similar to FIG. 20 but showing the lid flap in locked condition.

Referring now to the drawings, and more particularly to FIGS. 1 to 4 thereof, there is shown a machine in accordance with the present invention including a frame **10** and means for conveying cartons in timed order along from one end of the machine to the other in the direction indicated by the arrows in FIG. 1. The frame supports a constant speed motor **11** (FIG. 2) to the shaft of which is keyed a pulley **12**. As shown in FIGS. 2 and 4, the motor **11** drives a series of speed reduction sheaves **14**, **14***a* and **14***b* consisting of variously sized grooved wheels mounted on shafts **15**, **15***a* and **15***b* supported in the frame **10**. A V-belt variable speed unit **16** is also mounted in the frame and includes a handwheel **17** and a U-shaped bar **19** rotatable with the handwheel to swing the shaft **15** in an arc about the axis of the handwheel shaft to adjust the speed of rotation of the shaft **15**, thus or shafts **15***a* and **15***b* in a well known manner, the sheave **14** being adjustable automatically to alter the effective run of the V-belts therearound. The shaft **15***a* may be equipped with a handwheel **18** for enabling the operator to drive the machine by hand with the power off for trial runs. In this way an operator may be certain that various adjustments which will be discussed later are properly set for the particular cartons to be closed.

The final sheave **14***b* drives a transverse shaft **20** which is the main input shaft of the conveyor section of the machine and upon which are mounted a pair of V-belt sheaves **21** separated by a flat belt pulley wheel or drum **22**. Reeved about each of these sheaves **21** is a main conveyor V-belt **24** which extends substantially the full length of the machine and is reeved about similar sheaves **25** each of which is mounted on a transverse shaft **27** on either side of a flat belt pulley wheel or drum **26** at the pick-up end of the machine.

The shaft **20** also drives a shaft **29** through sheaves **20***a*, **20***b* and V-belt **20***c* (FIG. 2), thus also driving two outer chains **30**, and an inner chain **31**, the latter chain **31** being reeved about a sprocket wheel **32** which is keyed to the shaft **29**. This inner or center chain **31** is also reeved about a sprocket wheel **34** keyed to a transverse shaft **35** spaced inwardly of the infeed end of the machine. Thus the chain **31** extends along midway between the V-belts **24** and the outer chains **30** and all three chains travel in the same direction as the V-belts, that is, with their upper runs moving from left to right, as viewed, but the chains are driven at a speed slightly less than the speed of the V-belts **24**.

A series of abutment members **36** are uniformly spaced along the chain **31** and are fixed to it for movement therewith these members to serve a purpose which will later be described.

As shown in FIG. 2, the shaft **35** extends somewhat beyond one of its journal bearings and supports a sheave **35***a* which, through a series of V-belts **37** and **37***a*, sheaves **35***b*, **35***c* and **35***d*, along with shafts **39** and **39***a*, constitute a fixed reduction assembly in driving engagement with the shaft **27** through an adjustable speed reduction sheave **40**, V-belt **37***b* and sheave **35***e* keyed to the shaft **27**. At this point it should be mentioned that the drum **26** is keyed to the shaft **27** while the sheaves **25** rotate independently thereof by suitable bearings (not shown). Thus, the center chain drives shaft **27** through an adjustable speed reduction assembly to permit adjustment of the speed of the input driving the drum **26** to compensate for cartons of different sizes, larger cartons requiring greater speed, so that the machine will handle the same number of cartons per minute, regardless of the size of the cartons.

As has already been stated, the shaft **29** drives the outer chains **30** as well as the inner chain **31**, and for this purpose the shaft also supports a pair of sprockets wheels **41**, one on each side of the wheel **32**, for rotation therewith. Turning for the moment to FIG. 10, it will be seen that these sprocket wheels **41** are supported on the shaft **29** by a pair of friction nuts **42** providing an adjustable connection between the shaft **29** and the wheels **41** through friction members **44** acting in recesses **45** of the wheels **41**. The wheels **41** engage chains **30** which extend along the machine on either side of the chain **31** to sprocket wheels **47** keyed to idler shaft **49** mounted inwardly of the shaft **35** and just ahead of the closing elements which are yet to be described. The chains **30**

each carry a series of uniformly spaced gripping dogs 50 which may be merely flat plates secured to the chains and having upstanding flanges at their leading edges.

As has been stated, the machine is capable of accepting cartons fed to it from a random or a full line feed, and it will be usual for the cartons to be conveyed to the infeed end of the machine from a carton filling machine, for example. The speed of the closing machine main conveyor belts 24 will be greater than that of the conveyor delivering the cartons to the machine. The cartons will, therefore, be picked up by the drums 26, transferred to the belts 24 and moved along at high speed, thus spacing each carton from its adjacent cartons.

As shown in FIG. 4, the cartons C enter the machine at the left end, as viewed, with their lids open and bendably or hingedly connected to the leading face, and with their dust flaps extending upwardly. As each carton moves along, an abutment member 36 is brought up into its line of travel by the chain 31 and, since the chain 31 travels at a slightly slower speed than do the V-belts 24, the carton catches up to the abutment member next in advance of it and gently abuts its trailing edge. The carton thus assumes the speed of the chain 31 while the faster moving V-belts 24 slide past beneath it. Should an abutment member come up beneath a carton, the carton, still under the control of the faster moving V-belts 24 will pass over it and move on to the next abutment member. For this purpose, and as shown in FIGS. 6, 7 and 8, the abutment members are pivoted as at 28 relatively to the chain 31 and have a flat spring 33 having one end fixed relatively to the chain, and the other end extending up over the pivot and urging the abutment member gently upwardly. One such member is shown in broken lines in FIG. 6 beneath a carton, while another is shown in elevated position bearing against a carton.

It will be understood that a series of spaced idler belt wheels 51 are located along the upper runs of the belts 24 to prevent sagging, these wheels being mounted on idler shafts 52 journaled in the frame 10 (FIGS. 1 and 2).

As the cartons C move further along with their leading edges abutting the abutment members 36, they pass over the shaft 49 and sheaves 47 about which are reeved the dog carrying chains 30. From the description thus far, it will be understood that these dogs are adjustable by adjustment of the sheaves 41 relatively to the shaft 29 but that they move at the same speed as the abutment members. Actually, the dogs 50 are adjusted to come up over the sheaves 47 and turn just behind the cartons. The dog flanges then grip the trailing surface of the cartons so that the cartons are completely out of the control of the V-belts 24 and are securely held in a three-point grip between the dogs at the trailing end and the abutment member at the leading end thereof. It will, of course, be understood that the longitudinal distance between a pair of dogs and its next advanced abutment member is determined by the length of the carton being handled and may be varied to accommodate cartons of any length.

As the cartons are moved further along, they slide onto a set of four parallel rails 54 for solid support thereby in the region of the closing elements. When the cartons, after being closed by the closing elements, reach the area of the shaft 29, the abutment members 36 are drawn downwardly around the sprocket wheel 32 and the V-belts 24 again pick up the cartons and pull them away from the dogs 50, since the V-belts are moving somewhat faster than the dogs, thus enabling the dogs to make their end turn about the shaft 29 without interfering with the trailing surfaces of the cartons.

There having thus been described the carton conveying and timing means, there will follow a description of the carton closing elements.

Referring now to FIGS. 2, 4 and 5, a flat belt pulley wheel 57 keyed to a shaft 59 is driven together with the shaft by a timing belt 60 reeved about a pulley wheel 61 mounted on the shaft 29. It is important to note that this shaft 59 is the main input shaft for the closing elements, and that since the shaft 29 drives the carton conveying chains 30 and 31 as well as the shaft 59, a fixed time relationship exists between the center chain 31 and the closing elements.

As the cartons move into the area of the closing elements, their lids, which it will be remembered are hinged to the leading faces thereof, encounter a pair of lid rolls 58, as shown in FIG. 9. These rolls may conveniently rotate about the axis of a shaft 63 at a surface speed equal to the linear speed of the cartons, or the rolls may be stationary. In any event, it will be seen that the rolls will commence to bend the lid down towards its closed position.

However, before the lids can be closed, the dust flaps must be folded inwardly. This is done by mechanism which will now be described. As shown in FIGS. 11 and 12, a spline 62 drives a vertical shaft 64 having a gear 66 fixed to its lower end and enmeshed with gears 67 fixed to stub shafts 69 supported for rotation in the frame of the machine.

The stub shafts 69 are each centrally fixed, at their lower ends, to a disc 70, the discs therefore rotating with the shafts about their respective axes. Each disc 70 has a pin 71 depending eccentrically from it and the pins cooperate to support a single plate or dust flap bending element 72. The spline 62 derives its power directly from the shaft 59 by means which will be later described, it now being sufficient to understand that there is no provision for adjustment between the spline and the shaft 59, and hence between the center chain 31 and the plates 72.

As shown in FIGS. 5 and 9, there are actually two such plates 72, one on each side of the path of movement of the cartons, and due to the eccentricity of the pins 71 relatively to the shafts 69, the plates 72 move in orbital paths, as indicated by the arrows in FIG. 9. It will be seen that these paths take the plates inwardly towards the cartons and simultaneously along with them, and then outwardly and back in a direction opposed to the direction of movement of the cartons. As shown in broken lines in FIG. 12, the inner edge of the plates 72 move inwardly just far enough to engage and bend the carton dust flaps to folded position (FIG. 9). The bending surfaces 74 of the plates 72 are inclined as shown to prevent the exertion of force on the vertical side faces of the cartons.

Since the rolls 58 will have commenced bending the lid to closed position before the plates 72 have completed bending the dust flaps, the orbital paths of the plates in timed relation to the movement of the carton assures their withdrawal before they interfere with the closing lids. To further reduce the possibility of interference, the plates 72 may have downwardly inclined surfaces as at 75 (FIG. 9).

It will be appreciated then that, as the cartons pass the dust flap benders 72 and lid rolls 58, their dust flaps are bent inwardly and the lids are bent downwardly over the flaps.

It then becomes necessary to bend the lip flaps down into depending position adjacent the trailing front face of the carton and to lock the lid flap to this face. To accomplish these operations, there is provided a lid flap bending member 77 which is generally oval shaped in profile and has fingers 79 projecting from opposed ends thereof, as shown in FIGS. 3, 4, 5 and 9. This member 77 is mounted for rotation centrally of the shaft 63, upon which, it will be recalled, the lid rolls 58 may also be mounted. The ends of the fingers 79 project out beyond the perimeter of the rolls 58, as clearly shown, and have a normal surface speed greater than the speed of the cartons. As a carton lid is closed, one of the fingers, rotating counterclockwise as viewed in FIG. 4, contacts the carton lid flap C' and bends it to depending position

adjacent the trailing face of the carton as best shown in FIG. 5. At this point, since the finger has a surface speed greater than the linear speed of the carton, it is slowed down, by means yet to be described, so that the horizontal component of its speed, at the point of contact equals the carton speed. The finger, therefore, holds the lid flap C' in depending position as the carton moves along. It will be appreciated, however, that as the finger travels along the carton, it also has a vertical component, and this component wipes the depending flap upwardly lifting it and its locking tab C'' to a level above the locking slot C'''. Then, at this point in its cycle, another input signal is superimposed upon the movement of the member **77** suddenly increasing its speed and kicking the finger towards the carton to overrun it and depress the lid flap and the carton face, and to thereby open the slot C'''. Thus, the carton front face and lid flap are conditioned for locking engagement. The cartons and the member **77** are so timed that the opposed fingers **79** will act on alternate carton lid flaps. As shown in FIGS. 4 and 9, the carton will have advanced during the aforesaid conditioning until its lid is passing beneath a pair of opposed rocking levers **80** supported on a rock shaft **81**. These levers rock in vertical planes and lightly tap the carton lid downwardly to effect interlocking engagement of the lid flap locking tab C'' and the slot C'''. It will be understood, of course, that where too such locking tabs and slots are provided in the cartons, a pair of members **77** may be provided on the shaft **63**.

Cartons of the class contemplated herein are sometimes provided with locking tabs at the marginal regions along the sides of the lids and with corresponding locking slots in the dust flaps therebeneath, these tabs and slots being readily interlocked merely by depressing the marginal regions in which the tabs are formed, as clearly described in the aforementioned patent application, Serial No. 786,730. In order to effect interlocking thereof, auxiliary rolls **84** are provided on a shaft **85**, as shown in FIGS. 1 and 4. These rolls **84** preferably rotate at a surface speed equal to the linear speed of the cartons and are so dimensioned and located as to effect the depression of the marginal regions of the lid necessary to interlock the side locking tabs and dust flap slots as the cartons pass therebeneath. The surfaces of these rolls may also be utilized to apply a legend or code to the surface of the lid, if desired.

The cartons will, therefore, be securely closed and locked by the time they leave the auxiliary rolls **84**. As they reach the shaft **29** and sprocket **32**, providing an end turn for the abutment members **36**, the corresponding abutment member will be drawn downwardly out of the line of travel of the carton and the V-belts **24**, moving slightly faster than the chains **30** and **31** will take control of the cartons and move them away from the dogs **50** so that they may make their end turns without interfering with the cartons. The V-belts **24** then carry the cartons to the discharge end of the machine.

Having now described the several closing elements and their movements relatively to one another and to the cartons upon which they act to close and lock the same, I shall now proceed to a description of apparatus constituting one embodiment of means for controlling the operation of these elements.

Referring now to FIGS. 13, 14 and 15, the main input shaft **59** for the driving elements is shown having a gear **87** keyed to it and enmeshed with a gear **89** keyed to a shaft **90** mounted for rotation in the closing head frame. The gear **89** is in turn enmeshed with an idler gear **91** to drive the same about the axis of a shaft **92**, the idler gear **91** being enmeshed with a second idler gear **94** mounted for rotation about the axis of the shaft **63** (FIGS. 13 and 14) and enmeshed with a gear **96** keyed to the spline **62** which it will be recalled drives the dust flap benders as already described in connection with FIGS. 9, 11 and 12. Thus it will be seen that there is no provision for adjustment between the closing head input shaft **59** and the spline **62**, and that, since the shaft **59** rotates in timed relation to the chains **30** and **31** conveying the cartons past the driving elements, the dust flap benders are also timed relatively to the movement of the cartons.

As best shown in FIG. 15, the shaft **90** is keyed to a sun gear **97** and two ring gears **99** are enmeshed with planet gears **100** (two pairs of planet gears being preferred for balance although only single pair is shown) which also mesh with the sun gear. It will be appreciated that if the ring gears are held, and the sun gear rotated, the planets will run around the sun. Since, as shown, the planets are mounted on spiders **101** supported for rotation relatively to the shaft **90** and about the axis of that shaft, movement of the planets about the sun will cause the spiders to rotate.

The gear **91** on shaft **92**, besides driving the gear **94**, also drives a gear **102** keyed to the shaft **104**, thus rotating the shaft. As shown in FIG. 14, the shaft **104** is equipped with a differential similar to that just described in connection with the shaft **90** (FIG. 15). Thus, there are provided a sun gear **105**, ring gears **106** and planets **107** enmeshed with the sun and the rings and mounted in spiders **109**. One of the spiders **109** meshes with one disc of a compound gear **110** supported for rotation about the axis of a shaft **111**. The other disc of the gear **110** meshes with a spider **112** constituting part of a differential on the shaft **63**.

In this differential, however, the sun gear **114** idles on the shaft **63**, and the spider **112** delivers a uniform input to the planet **115** mounted therein drawing it around the sun and rotating the sun since the ring **116** with which it is meshed is controlled by means to be described. The rotating sun drives the upper planet **115***a*, and again because the ring gear **116***a* with which this planet is enmeshed is controlled by means to be described, the planet **115***a* rotates about the sun and draws its spider **117**, and the shaft **63** to which the latter spider is keyed along with it. As stated hereinbefore, this shaft **63** carries the lid flap bending member **77** and its fingers **79**.

The angular position of the member **77** may be adjusted to advance or retard the fingers **79**, and for this purpose, there is provided an adjusting stud **119** having a worm gear **120** enmeshed with a worm wheel **121** on shaft **122**, as shown in FIGS. 13 and 18. This shaft **122** carries a pair of pinions **124** and **124***a* for rotation thereabout. The upper pinion **124** is in meshing engagement with one of the ring gears **106** on shaft **104**. Thus, adjustment of the stud **119** adjusts the position of that ring gear **106** and imposes a signal on the compound gear **110** on shaft **111**, the spider on shaft **63** and its differential, and finally adjusts the angular position of the shaft **63** itself and, of course, the lid flap bending member **77**.

It has been pointed out that the speed of revolution of the member **77** is not constant, but that at a point in each half-cycle, it slows somewhat so as not to overrun the cartons, and then is suddenly kicked ahead to depress the lid flap and carton face to condition them for interlocking engagement. For this purpose, a cam plate **126** (FIGS. 13 and 14) is mounted on the constant input gear **112** on shaft **63** and is formed with a cam track **127** so contoured as to cause oscillation of a follower **129** fixed on the end of a follower arm **130**, the other end of which is welded to a gear **131** idling on the shaft **111**. The gear **131** is also enmeshed with a gear **132** idling on shaft **62** and welded to a bushing **134** sleeved over the shaft **62**. A second gear **135** is also welded to this bushing **132** and is enmeshed with a ring gear **116***a* on the shaft **63**, as clearly shown in FIG. 14. Thus, the oscillations of the cam follower cause the gear **131**, to rock about the axis of shaft **111**, rocking the gears **132** and **135** about the axis of the shaft **62** and the ring gear **116***a* about the axis of shaft **63**. There is thus superimposed a further signal upon the shaft **63** and the member **77** causing their angular velocity to vary as determined by the contour of

the cam track to prevent the fingers from overrunning the cartons. Since the cam plate **126** is mounted on the gear **112** which rotates at uniform velocity, changing the input to a new position, as by the stud **119**, automatically changes the position of the cam plate accordingly.

As I have already mentioned, an additional signal is required for the member **77** in order to kick it ahead at the proper time to open the slot in the front face of the carton to place the slot and the locking tab on the lid flap in condition for interlocking engagement. A cam plate **137** having a track **139** is fixed to one of the spiders **109** on the shaft **104**, as best shown in FIG. 14, and a cam follower **140** mounted on an arm **141** is guided in the track by movement of the cam plate **137**. As shown in FIG. 13, the cam track takes a path around the axis of the shaft **104**, but has a pair of opposed inwardly directed bends or humps. The arm **141** is keyed to the shaft **92** to which there is also keyed a gear segment **142** which meshes with the ring gear **116** on the shaft **63**. It will be seen then that as the shaft **104** rotates, the cam track humps causes sudden oscillations in the follower, its arm, and the segment **142** and also in the ring gear **116** thus imposing a further signal on the spider **117** and the shaft **63** through the planets **115***a* carried by that spider. From the construction of the differential on the shaft **63**, it will be appreciated that a uniform input is delivered to the shaft **63** through the spider **112** and sun **114** while the ring gear **116***a* is controlled in its movement by the gear **135** on the shaft **62** which is in turn controlled by the cam **129** moving in the track of the cam plate **126** to superimpose predetermined signals on the shaft **63**. At the same time, the ring gear **116** is controlled by the segment **142** which is in turn actuated by the cam **140** in the cam track **139** rotating on the shaft **104** to superimpose a still further signal upon the shaft **63** thus to obtain the desired movement of that shaft, as already described.

An additional stud **136** is provided (FIG. 18) having a worm gear **138** thereon enmeshed with a worm wheel **143**. This wheel is connected to the pinion **124***a* by a suitable bushing, the pinion **124***a* being enmeshed with the lower ring gear **106** on the shaft **104**. Thus, manual adjustment of the stud **136** effects adjustment of the lower ring gear **106**, the lower spider **109** (FIG. 14), the cam plate **137**, cam **140**, arm **141**, shaft **92** and gear segment **142**. Accordingly, the ring gear **116** on shaft **62** is also adjusted moving its planets **115**, spider **112**, cam plate **126**, cam **129**, gears **131**, **132** and **135**, spider **117** and shaft **63**. Thus, the angular relationship of the cam plates **126** and **137** is adjustable so that the sudden increase in speed or kick of the horizontal component of the fingers **79** provided by the cam plate **137** can be varied relatively to the angular position of the member **77**.

Referring now to FIGS. 13, 15 and 16 I shall proceed to a description of the mechanism for operating the rocking levers **80** which tap the carton lid to closed position after the lid flap locking tab and the slot on the front face have been conditioned for interlocking engagement. As shown in FIG. 15 the gear **87** on the main input shaft **59** drives the gear **89** and the shaft **90** keyed to it. This shaft **90** has a differential assembly which has already been described in connection with earlier mentioned closing elements. In any event, the ring gears of this differential are controlled by means yet to be described so that the sun gear **97**, being keyed to the shaft **90**, rotates with it and causes the planets **100** to revolve around the shaft axis drawing the spiders **101** in which they are mounted, around with them. As shown in FIG. 16, the upper spider meshes with a gear **144** which idles on the shaft **81** and drives a gear **145** and the shaft **85** to which it is keyed. Simultaneously, the lower spider engages and drives a gear **146** idle on the shaft **81** but fixed to a second gear **147** which, in turn, drives a gear **149** welded to a bushing **150** rotatably carried on the shaft **85**. This bushing **150** therefore, rotates with the gear **149** and has a cam plate **151** welded to it. The cam plate is formed with a cam track **152** which follows a circular path eccentrically disposed relatively to the axis of the shaft **85**, as clearly shown in FIG. 13. A follower **154** is mounted at the end of a follower arm **155** and extends into the track for oscillating movement as the cam plate rotates. The arm **155** is keyed to the shaft **81** and so rocks the same, along with the rocking levers **80**. As has been mentioned, the ring gears **99** are controlled so that the sun gear **97** rotates the spiders **101**. Turning to FIGS. 13 and 17, there is shown an adjusting stud **156** having a worm gear **157** at its lower end meshing with a worm wheel **159**. This wheel is welded to a bushing **160** freely supported on a shaft **161** in driving engagement with the lower ring gear **99** on the shaft **90**. Manual adjustment of the stud **156** therefore adjusts this ring gear and its corresponding planet **100**, the spider **101**, gears **146** and **147** on shaft **81**, gear **149** on shaft **85** and thus the angular position of the cam plate **151** together with the cam arm **155** and shaft **81** carrying the levers **80**.

Referring to FIG. 19, one of the fingers **79** is shown bending the lid flap C' downwardly to depending position adjacent the carton face and following it along horizontally, raising the flap relatively to the face while maintaining it adjacent the face and then overrunning the carton to depress the flap and the carton face to open the locking slot C'''. At this point, the rocking arm **80** taps the lid downwardly to insert the locking tab into the slot thus locking the flap and face together. In this connection, FIGS. 20 and 21 illustrate somewhat more clearly the actual interlocking of the lid flap and front face of a typical paper board carton of the type contemplated herein.

The angular position of the auxiliary side locking and coding rolls **84** mounted on the shaft **85** may be adjusted by manual setting of a stud **164** similar to stud **156** (FIG. 17) and carrying a worm gear **165** enmeshed with a worm wheel **166**. A bushing **167** is freely supported on the shaft **161** and is welded to the wheel **166** and to a pinion **169** enmeshed with the upper ring gear **99** on hte shaft **90**. Thus adjustment of the stud **164** adjusts the upper ring gear **99** through the members mechanically connecting the two and this, in turn, adjusts the upper spider **101**, the idler gear **144** on shaft and the gear **145** keyed to the shaft **85** which carries the auxiliary rolls.

A further adjusting stud **170** is provided and extends downwardly through the closing head to a right angle transmission **171** which drives a horizontal shaft **172** equipped with worm gears **174** at each end thereof meshing with corresponding worm wheels **175** fixed on threaded studs **176** rotatably engaged in the frame of the closing head and supported on the main frame **10** of the machine. Thus, the entire closing head may be raised and lowered relatively to the main frame by adjustment of the stud **170**.

From the foregoing description, it will be seen that the present invention contributes a machine for receiving cartons to be closed from a full line or random feed and conveying the cartons past closing elements at a constant high speed, and in fact, through the entire machine at a substantially constant speed, without altering the direction of movement or the elevation of the cartons. The cartons are not stopped, raised or lowered and no gating is required so that the contents thereof are not shifted or spilled. Machines such as that described have closed cartons at a rate well over 250 cartons per minute and could handle upwards of approximately 400 per minute. It will also be seen that the machine is universal. Thus, the speed with which cartons are received in the machine is adjustable to enable the same number of cartons of different length to be handled in a given time unit. The height of the closing elements may be adjusted to accommodate cartons of different height and the angular posi-

tion of the fingers 79 may be adjusted together with the occurrence of the sudden speed increase thereof to permit the fingers to act upon cartons of various sizes. Furthermore, the angular positions of the rocking levers 80 and the side locking and coding rolls may also be adjusted. Lateral adjustment of the dust flap folding members and the rocking levers is permitted because of the use of splines for delivering the input to these respective elements.

It is thought that the construction and operation of the present novel carton closing machine will now be understood and that the advantages of the invention will be fully appreciated by those persons skilled in the art.

I claim:

1. In a carton closing machine of the class described, closing elements, conveying means for receiving cartons to be closed in random or full line disposition and advancing them continuously at a given speed towards said closing elements, timing means adjacent said conveying means intercepting the cartons without interrupting the advance thereof and continuously conveying them at a slightly slower speed in the same direction while spacing them to reach the closing elements in timed relation to the operating cycles of such elements, such elements then acting to close the cartons as they are conveyed by the timing means, and means returning the closed cartons to said conveyor means for conveying them at said given speed to a discharge station, the movement of said cartons being uni-directional and continuous through the machine.

2. In a carton closing machine of the class described, closing elements, conveyor belt means having a run for receiving cartons to be closed in random or full line disposition and advancing them continuously at a given speed towards the closing elements, timing belt means having a run substantially in the plane of said first run and moving in the same direction thereas but at a slightly slower speed, said timing belt means including means engaging said cartons without interrupting the advance thereof whereby their speed and spacing is controlled by said second run as they pass said closing elements, said elements then acting to close the carton, and means releasing said cartons after they are closed from control of said timing belt means whereby said conveyor belt means again control the movement of said cartons to a discharge station, the movement of said cartons being uni-directional and continuous through the machine.

3. In a carton closing machine, closing elements, a belt run for continuously conveying cartons to be closed at a given speed towards said closing elements, a second belt run substantially in the plane of said first run and at least partially co-extensive therewith and moving continuously in the same direction of travel thereof but at a slightly slower speed, spaced means on said second run engaging the leading surfaces of said cartons to control the speed thereof past said closing elements, and means driving said closing elements in timed relation to the speed of said advancing cartons under the control of said second run whereby said elements act on said cartons to close same as they move under control of said second run, the movement of said cartons being uni-directional and continuous through the machine.

4. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including a member engaging the carton lid flap to bend the same to depending position and then lift the depending flap relatively to the carton face, said member advancing with the carton, and means accelerating said member relatively to the carton causing same to overrun the carton and depress the carton face and lid flap to condition the face and flap for interlocking engagement.

5. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including means for depressing the carton lid to substantially closed position and a member engaging the carton lid flap to bend the same to depending position and then lift the depending flap relatively to the carton face, said member advancing with the carton, and means accelerating said member relatively to the carton causing same to overrun the carton and depress the carton face and lid flap to condition the face and flap for interlocking engagement.

6. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including means for depressing the carton lid to substantially closed position and a member engaging the carton lid flap to bend the same to depending position and then lift the depending flap relatively to the carton face, said member advancing with the carton, means accelerating said member relatively to the carton causing same to overrun the carton and depress the carton face and lid flap to condition the face and flap for interlocking engagement, and means for effecting interlocking of said carton face and lid flap.

7. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including a lid flap control member, means rotating said member at a timed speed of rotation during a major portion of its cycle of rotation to bring a working surface of said member into working position relatively to carton lid flaps as each carton approaches said member, said working surface bending the lid flap to depending position, means altering the speed of rotation of said member to give said working surface a component substantially equal to the linear speed of the carton thus to maintain said working surface in engagement with the lid flap while another component lifts the lid flap relatively to the carton face, and means for increasing said first component during a predetermined portion of the cycle of rotation of said member whereby said working surface overruns the carton and depresses the carton face and lid flap to condition the face and lid flap for interlocking engagement.

8. In a carton closing machine of the class described, closing elements, means for advancing cartons to be closed past said elements at substantially uniform speed, said elements including a rotating member having a working surface for conditioning the carton lid flap for interlocking engagement with the carton face, and control means rotating said member at a speed to bring said working surface into working position relatively to a lid flap as a carton approaches said member, said control means including signal transmission means serving to adjust the angular speed of said working surface whereby one of its linear components is substantially equal to the linear speed of the carton thus to maintain the flap in position adjacent the carton face while another component effects a wiping action between the flap and face to reposition same relatively to one another, said control means also including signal transmission means accelerating the angular velocity of said member in timed relation to the movement of said carton to cause said working surface to overrun the carton face and lid flap thus depressing same to condition the face and lid flap for interlocking engagement.

9. In a carton closing machine of the class described, closing elements, means for advancing cartons to be closed past said elements at substantially uniform speed, said elements including a rotating member having a working surface for conditioning the carton lid flap for interlocking engagement with the carton face, control means rotating said member at a speed to bring said working surface into working position relatively to a lid flap as a carton approaches said member, said control means including signal transmission means serving to adjust the angular speed of said working surface whereby one of its linear components is substantially equal to the linear speed of

the carton thus to maintain the flap in position adjacent the carton face while another component effects a wiping action between the flap and the face to reposition same relatively to one another, said control means also including signal transmission means accelerating the angular velocity of said member in timed relation to the movement of said carton to cause said working surface to overrun the carton face and lid flap thus depressing same to condition the face and lid flap for interlocking engagement, and means for effecting interlocking of said carton face and lid flap.

10. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including opposed dust flap folding members, means moving said members in opposed orbital paths in time with the advancing cartons whereby said members engage and fold the dust flaps while moving along with the carton, and a member engaging the carton lid flap after the dust flaps are folded to bend the lid flap to depending position and then lift the depending flap relatively to the carton face, said member advancing with the carton, and means accelerating said member relatively to the carton causing same to overrun the carton and depress the carton face and lid flap to condition the face and flap for interlocking engagement.

11. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including opposed dust flap folding members, means moving said members in opposed orbital paths in time with the advancing cartons whereby said members engage and fold the dust flaps while moving along with the carton, means folding the carton lid to closed position overlying the folded dust flaps, a lid flap control member and means rotating said member at a timed speed of rotation during a major portion of its cycle of rotation to bring a working surface of said member into working position relatively to the carton lid flaps as each carton approaches said member, said working surface bending the lid flap to depending position, means altering the speed of rotation of said member to give said working surface a component substantially equal to the linear speed and direction of the carton thus to maintain said working surface in engagement with the lid flap while another component lifts the lid flap relatively to the carton face, and means for increasing said first component whereby said working surface overruns the carton and depresses the carton face and lid flap to condition the face and lid flap for interlocking engagement.

12. In a carton closing machine of the class described, closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including opposed dust flap folding members, means moving said members in opposed orbital paths in time with the advancing cartons whereby said members engage and fold the dust flaps while moving along with the carton, a lid flap control member, and means rotating said member at a timed speed of rotation during a major portion of its cycle of rotation to bring a working surface of said member into working position relatively to the carton lid flaps as each carton approaches said member, said working surface bending the lid flap to depending position, means altering the speed of rotation of said member to give said working surface a component substantially equal to the linear speed and direction of the carton thus to maintain said working surface in engagement with the lid flap while another component lifts the lid flap relatively to the carton face, means for increasing said first component whereby said working surface overruns the carton and depresses the carton face and lid flap to condition the face and lid flap for interlocking engagement, and means for effecting interlocking engagement of said carton face and lid flap.

13. In a carton closing machine of the class described, closing elements, conveying means for receiving cartons to be closed and conveying them at a given speed towards said closing elements, timing means intercepting the cartons and continuously conveying them at a substantially uniform speed past said closing elements while spacing them to reach said closing elements in timed relation to the operating cycles of such elements, said elements including opposed dust flap folding members, means moving said members in opposed orbital paths in time with the advancing cartons whereby said members engage and fold the dust flaps while moving along with the cartons, a lid flap control member, and means rotating said member at a timed speed of rotation during a major portion of its cycle of rotation to bring a working surface of said member into working position relatively to the carton lid flaps as each carton approaches said member, said working surface bending the lid flap to depending position, means altering the speed of rotation of said member to give said working surface a component substantially equal to the linear speed and direction of the carton thus to maintain said working surface in engagement with the lid flap while another component lifts the lid flap relatively to the carton face, and means for increasing said first component whereby said working surface overruns the carton and depresses the carton face and lid flap to condition the face and lid flap for interlocking engagement.

14. In a carton closing machine of the class described, closing elements, conveying means for receiving cartons to be closed and conveying them at a given speed towards said closing elements, timing means intercepting the cartons and continuously conveying them at a substantially uniform speed past said closing elements while spacing them to reach said closing elements in timed relation to the operating cycles of such elements, said elements including opposed dust flap folding members, means moving said members in opposed orbital paths in time with the advancing cartons whereby said members engage and fold the dust flaps while moving along with the cartons, means folding the carton lid to closed position overlying the folded dust flaps, a lid flap control member, and means rotating said member at a timed speed of rotation during a major portion of its cycle of rotation to bring a working surface of said member into working position relatively to the carton lid flaps as each carton approaches said member, said working surface bending the lid flap to depending position, means altering the speed of rotation of said member to give said working surface a component substantially equal to the linear speed and direction of thecarton thus to maintain said working surface in engagement with the lid flap while another component lifts the lid flap relatively to the carton face, means for increasing said first component whereby said working surface overruns the carton and depresses the carton face and lid flap to condition the face and lid flap for interlocking engagement, and means for effecting interlocking engagement of said carton face and lid flap.

15. In a machine for closing cartons of the type having a lid attached to one vertical face thereof, a flap at the end of the lid, dust flaps attached to side faces thereof, means for interlocking the lid flap and one of the vertical faces and means for interlocking marginal regions of the lid and the dust flaps, the combination comprising closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including means for bending the carton lid to closed position and effecting interlocking engagement of the carton lid flap with the front face thereof and means depressing the side marginal regions of the carton lid relatively to the area of said lid intermediate the side marginal regions thereof to effect interlocking engagement between said edges and the dust flaps therebeneath.

16. In a machine for closing cartons of the type having a lid attached to one vertical face thereof, a flap at the

end of the lid, dust flaps attached to side faces thereof, means for interlocking the lid flap and one of the vertical faces and means for interlocking marginal regions of the lid and the dust flaps, the combination comprising closing elements, and means for advancing cartons to be closed past said elements at a substantially uniform speed, said elements including a member engaging the carton lid flap to bend the same to depending position and then lift the depending flap relatively to the carton face, said member advancing with the carton, means accelerating said member relatively to the carton causing same to overrun the carton and depress the carton face and lid flap to condition the face and flap for interlocking engagement, means for effecting interlocking of said carton face and lid flap, and means flexing the side marginal regions of the carton lid to effect interlocking engagement between said edges and dust flaps therebeneath.

17. In a carton closing machine, means conveying cartons to be closed continuously along a predetermined path, closing elements acting upon said cartons to close same as they are so conveyed, said closing elements including a member rotating in timed relation to the movement of said cartons and engaging and bending the lid flaps of said cartons to depending position, the movement of said member having a component in the direction of movement of said cartons equal to the speed of said cartons during a portion of its cycle and having a further component moving the carton lid flap relatively to the adjacent carton face, means increasing suddenly said first component to cause said element to overrun said lid flap and face, and means for adjusting the time of occurrence of said sudden increase of said first component relatively to the angular position of said member.

18. A method of closing cartons of the type having a lid attached to one vertical face thereof, a flap at the end of the lid, means for interlocking the lid flap and one of the vertical faces of the carton, a dust flap attached to each side face thereof, locking slots in the dust flaps, and means at marginal regions of the sides of the cover for interlocking with the dust flap slots, such method comprising the following steps: moving the carton continuously at substantially constant speed in a single direction along the machine, bending the dust flaps inwardly, bending the lid to closed position over the dust flaps, bending the lid flap to depending position adjacent a face of the carton, locking the lid flap and adjacent carton face together, and pressing the marginal areas of the sides of the cover downwardly to effect interlocking of the dust flap slots and the means on the cover for interlocking engagement therewith.

19. In a carton closing machine of the class described, closing elements, conveying means receiving in random or full line disposition cartons to be closed and continuously advancing them at a given speed towards said closing elements, timing means comprising second and third conveying means substantially in the plane of and at least partially co-extensive with said first mentioned conveying means, said second conveying means including elements intercepting the cartons without interrupting the advance thereof and permitting the continuous advance thereof at a slightly slower speed and in the same direction, said third conveying means including means cooperating with said elements of said second conveying means to grip the cartons therebetween, said timing means operating to space the cartons for action thereon by said closing elements, and means driving said closing elements in timed relation to the speed of said cartons advancing under the control of said timing means to close the same.

20. In a carton closing machine, the combination comprising, closing elements, conveying means for receiving cartons to be closed and continuously advancing them at a given speed towards said closing elements, second conveying means subtantially in the plane of said first mentioned conveying means and moving in the same direction thereas but at a slightly slower speed, abutment means carried by said second conveying means and adapted to extend into the path of said advancing cartons to abut the leading faces thereof and so reduce the speed thereof to the speed of said second conveying means, said second conveying means moving in timed relation with said closing elements and acting to space the cartons for action by said closing elements, said abutment means including a plate, pivot means mounting said plate for rocking movement relatively to said second conveying means and spring means urging said plate into position to abut the advancing cartons with its trailing edge.

21. In a carton closing machine, the combination comprising, closing elements, conveying means for receiving cartons to be closed and continuously advancing them at a given speed towards said closing elements, second conveying means substantially in the plane of said first mentioned conveying means and at least partially co-extensive therewith and moving in the same direction thereas but at a slightly slower speed, abutment means carried by said second conveying means and adapted to extend into the path of said advancing cartons to abut the leading faces thereof and so reduce the speed thereof to the speed of said second conveying means, said second conveying means moving in timed relation with said closing elements and acting to space the cartons for action thereon by said closing elements, said abutment means including a plate, pivot means mounting said plate for rocking movement relatively to said second conveying means and spring means urging said plate into position to abut the advancing cartons with its trailing edge, the force of the spring being less than the weight of the cartons and their contents.

22. A method of closing cartons of the class having a lid attached to one vertical face thereof, a flap at one end of the lid, a tongue on said flap slot means in the vertical carton face opposite said first mentioned carton face, and a dust flap attached to each side face thereof, the sides of said lid and said dust flaps having cooperating interlocking means, such method comprising the following steps: advancing the carton in a position such that the vertical face thereof to which the lid is attached constitutes the leading face of the carton as it moves, bending the dust flaps inwardly, bending the lid substantially to closed position, bending the lid flap to depending position adjacent the slotted face of the carton, lifting the lid slightly relatively to said carton face, depressing the lid flap and adjacent carton face to condition said tongue and slot for interlocking engagement, inserting said tongue into said slot, and locking the sides of said lid to said dust flaps by means of said cooperating interlocking means.

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