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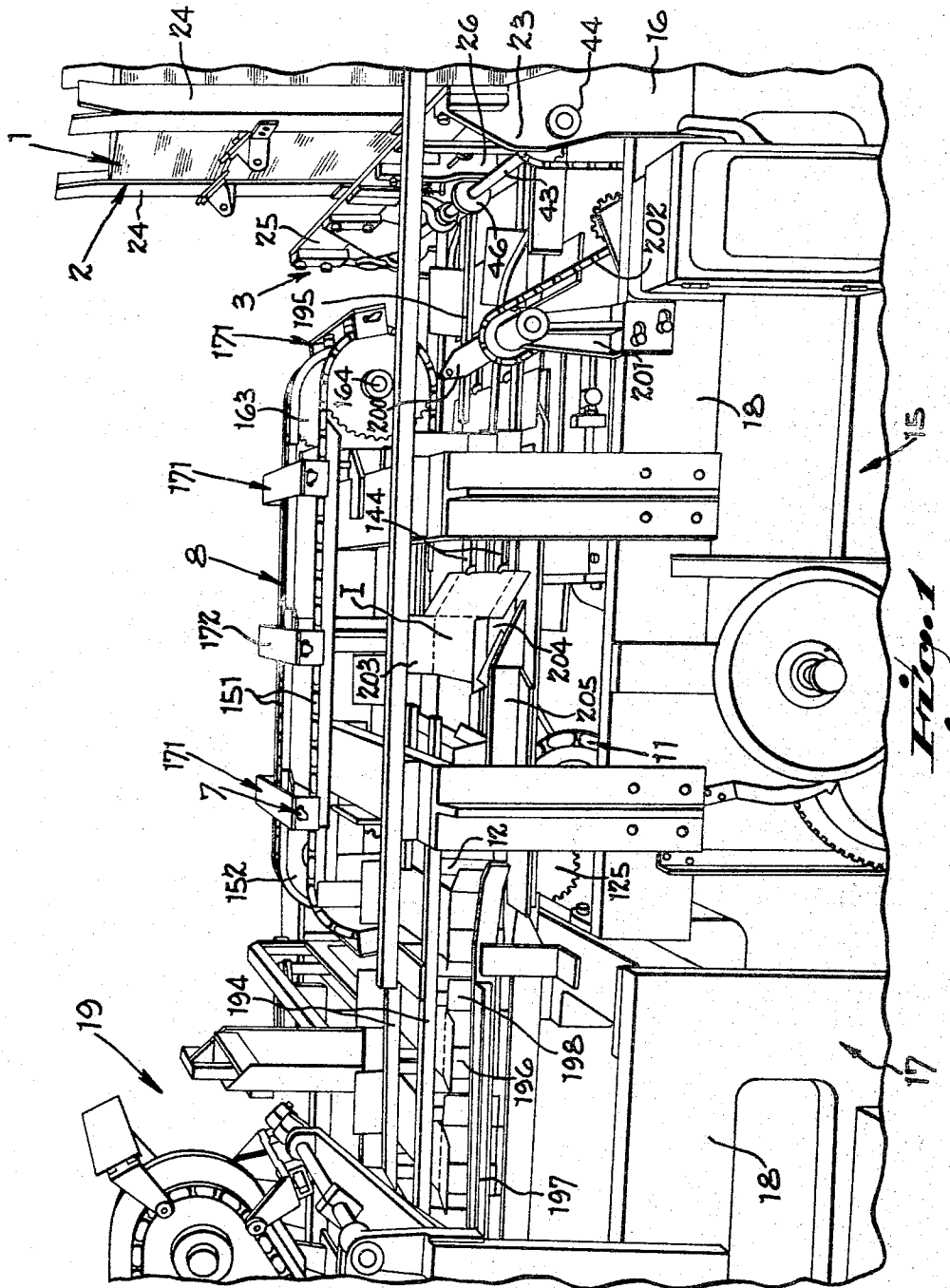
W. JONES

3,333,514

PROGRESSIVE CARTON HANDLING MECHANISM FOR CARTONING MACHINES

Filed March 16, 1964

18 Sheets-Sheet 1



INVENTOR.
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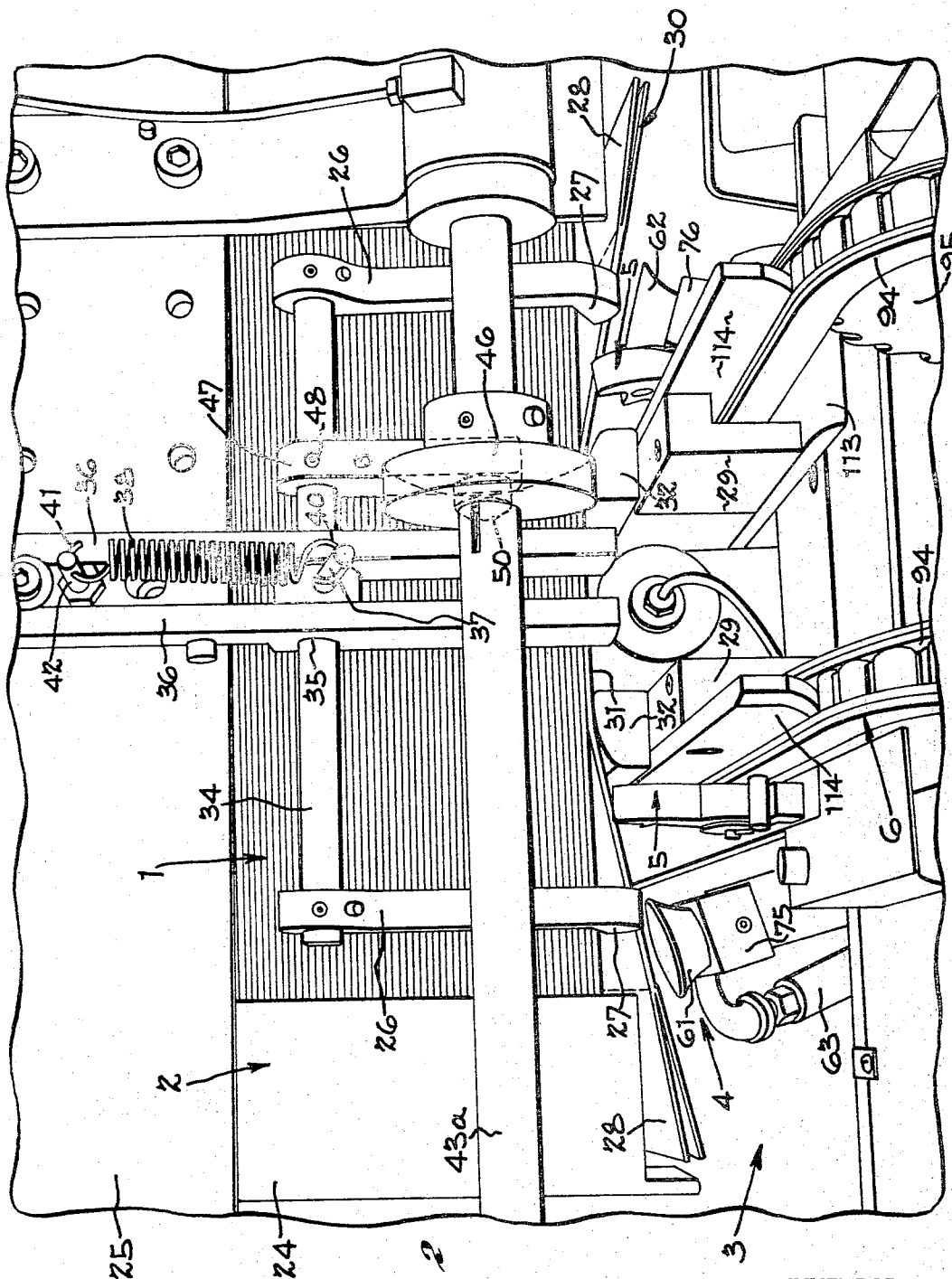
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PROGRESSIVE CARTON HANDLING MECHANISM FOR CARTONING MACHINES

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18 Sheets-Sheet 2



Sheet 2

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18 Sheets-Sheet 3

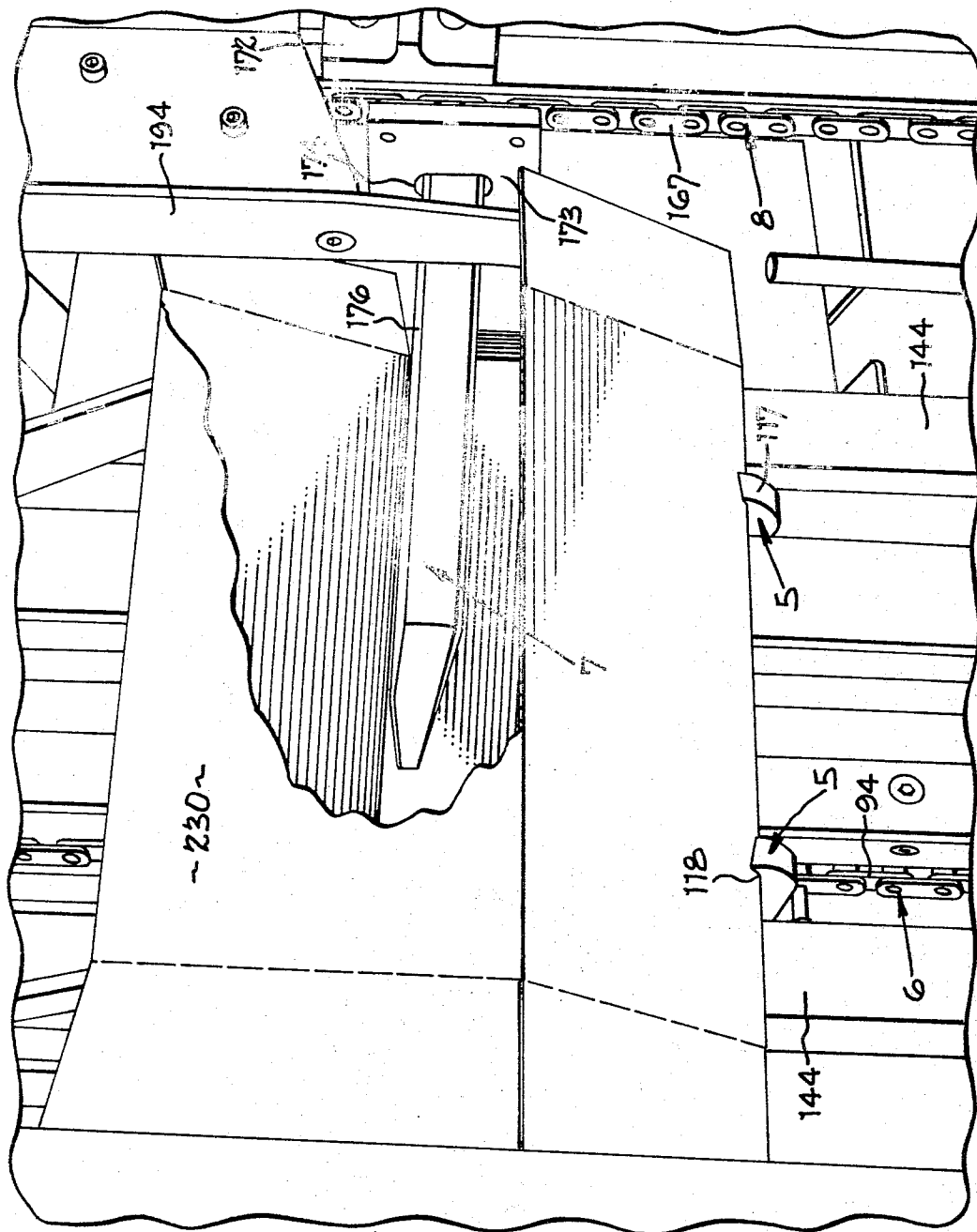


Fig. 3

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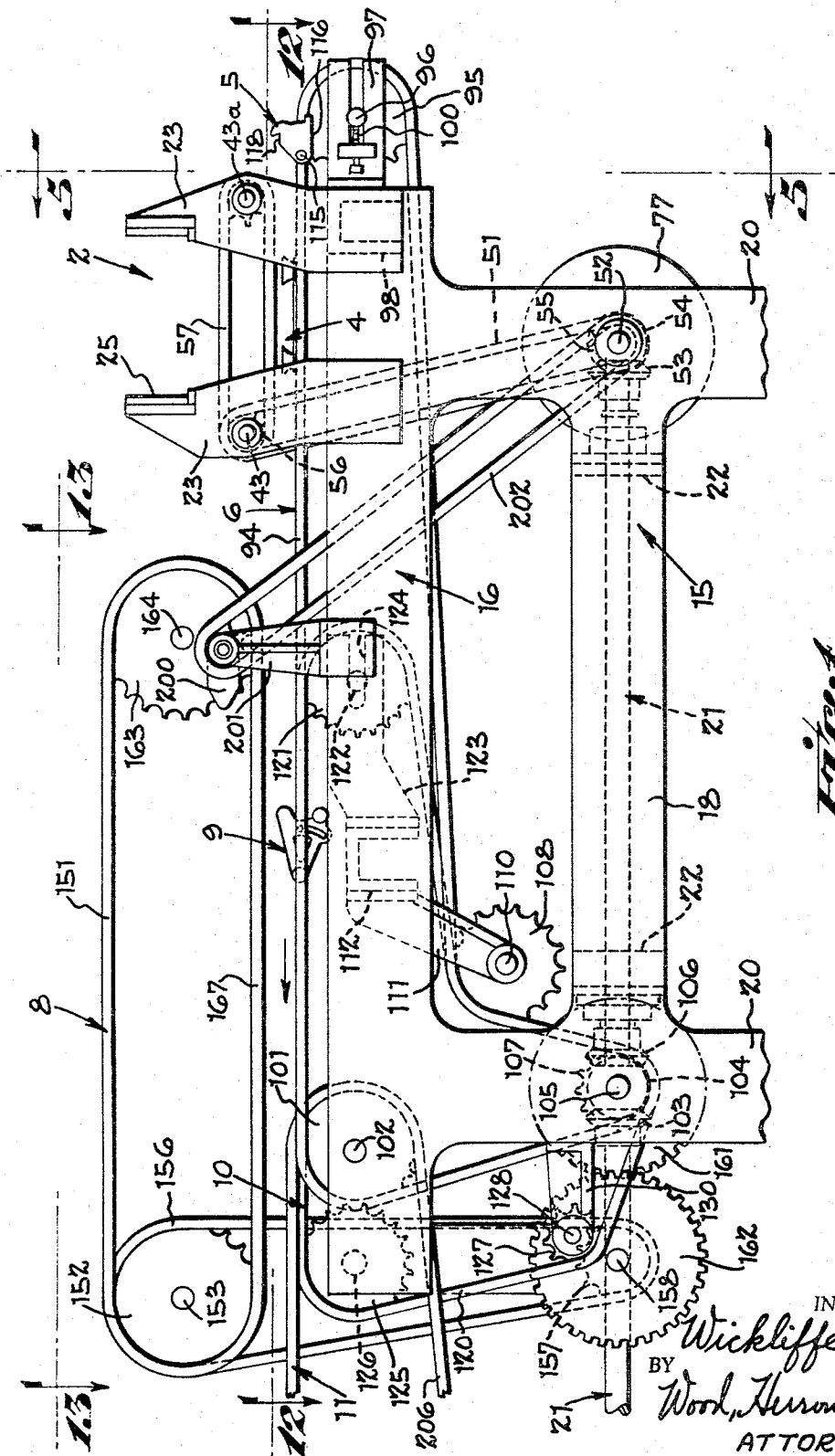
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18 Sheets-Sheet 4



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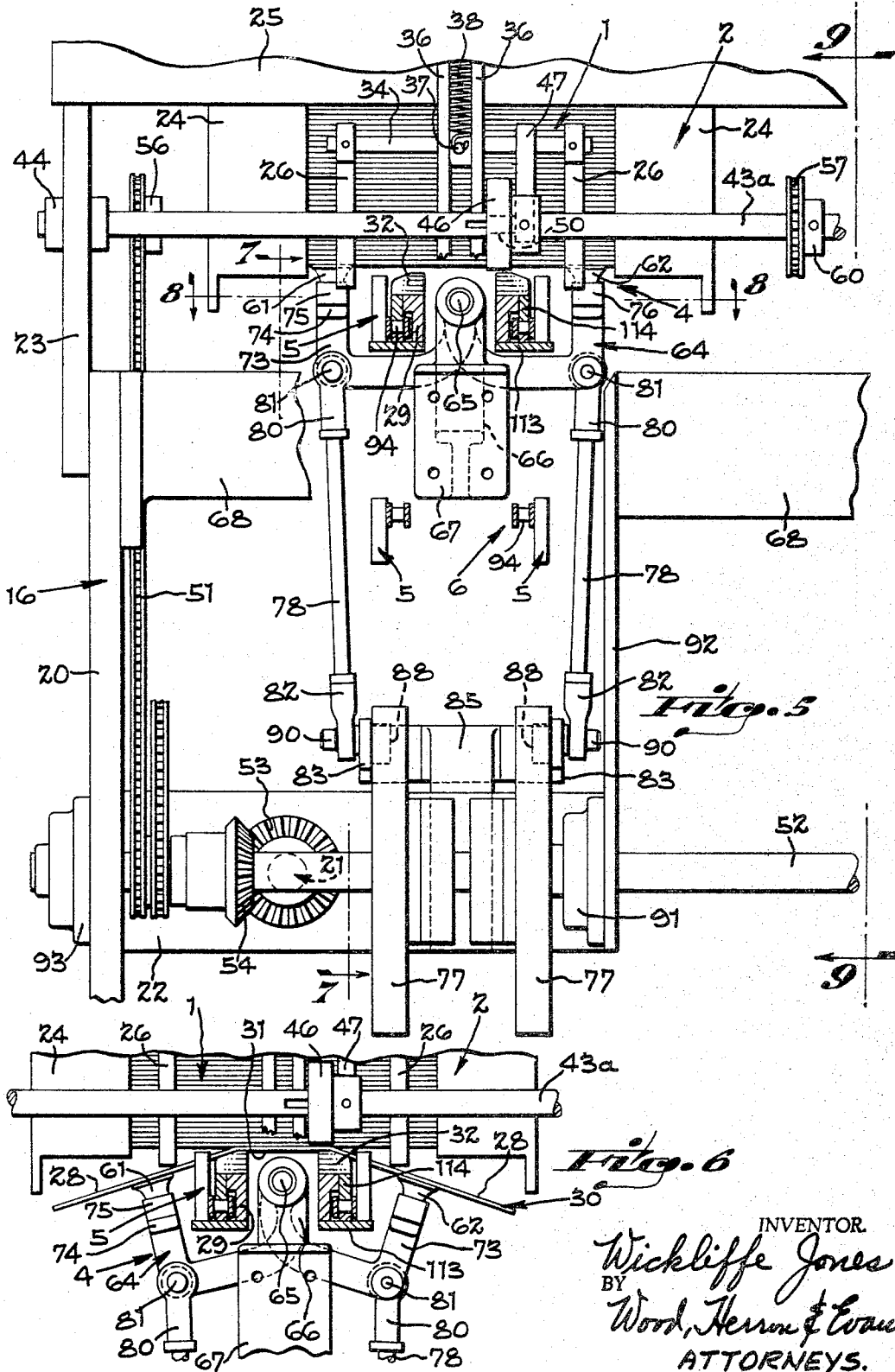
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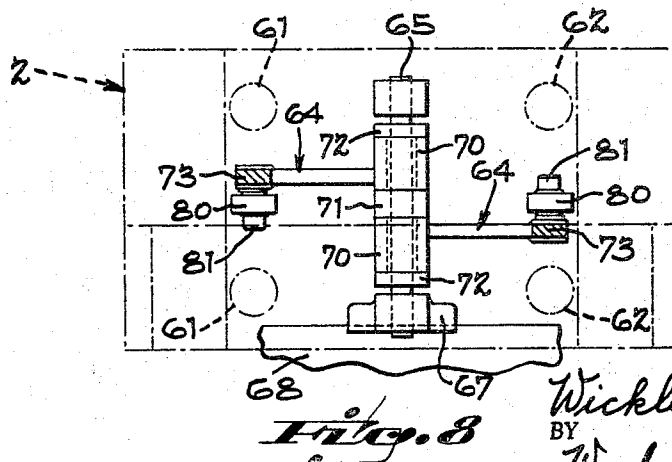
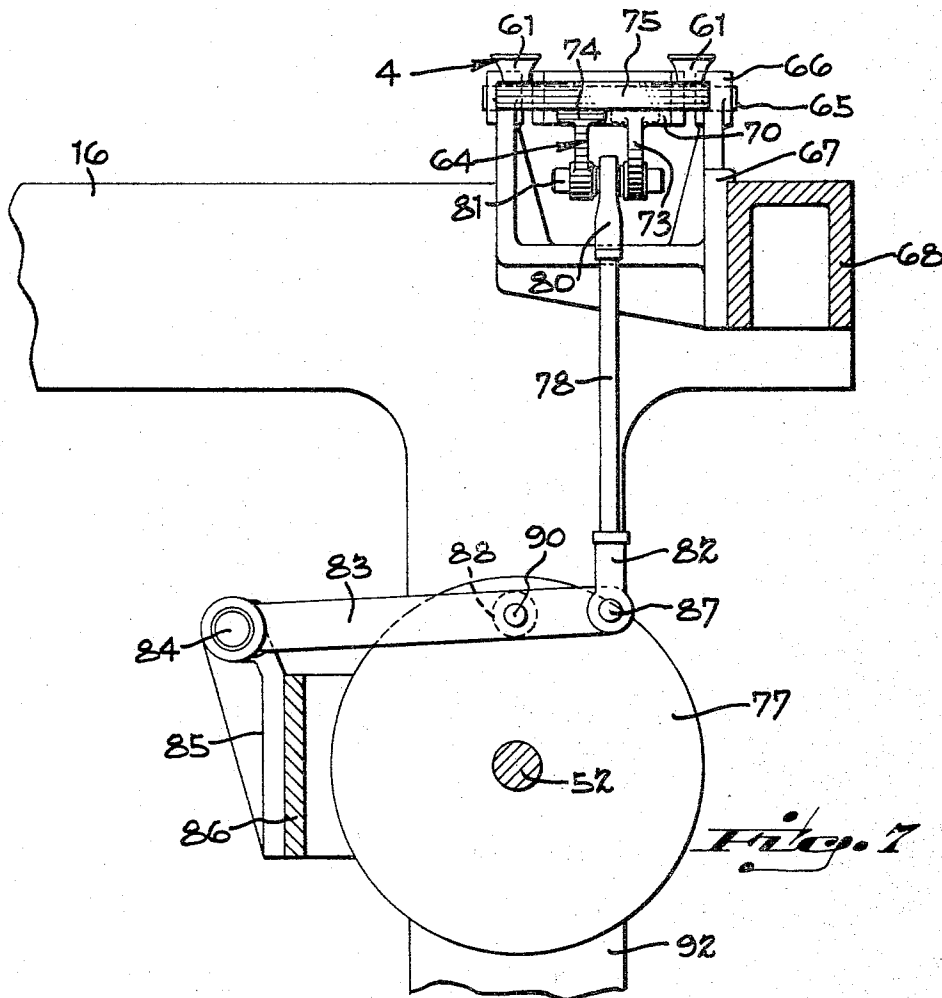
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18 Sheets-Sheet 6



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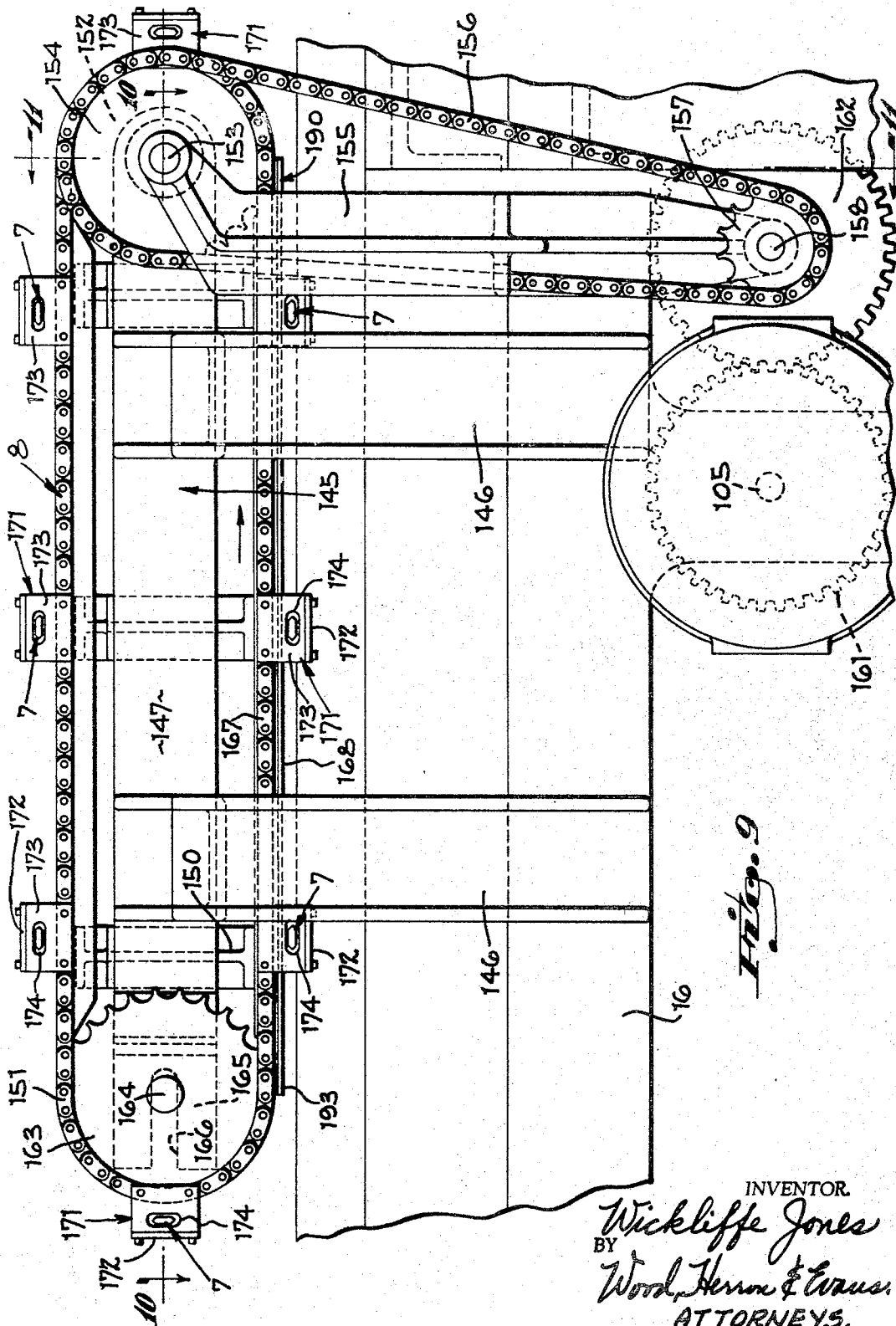
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PROGRESSIVE CARTON HANDLING MECHANISM FOR CARTONING MACHINES

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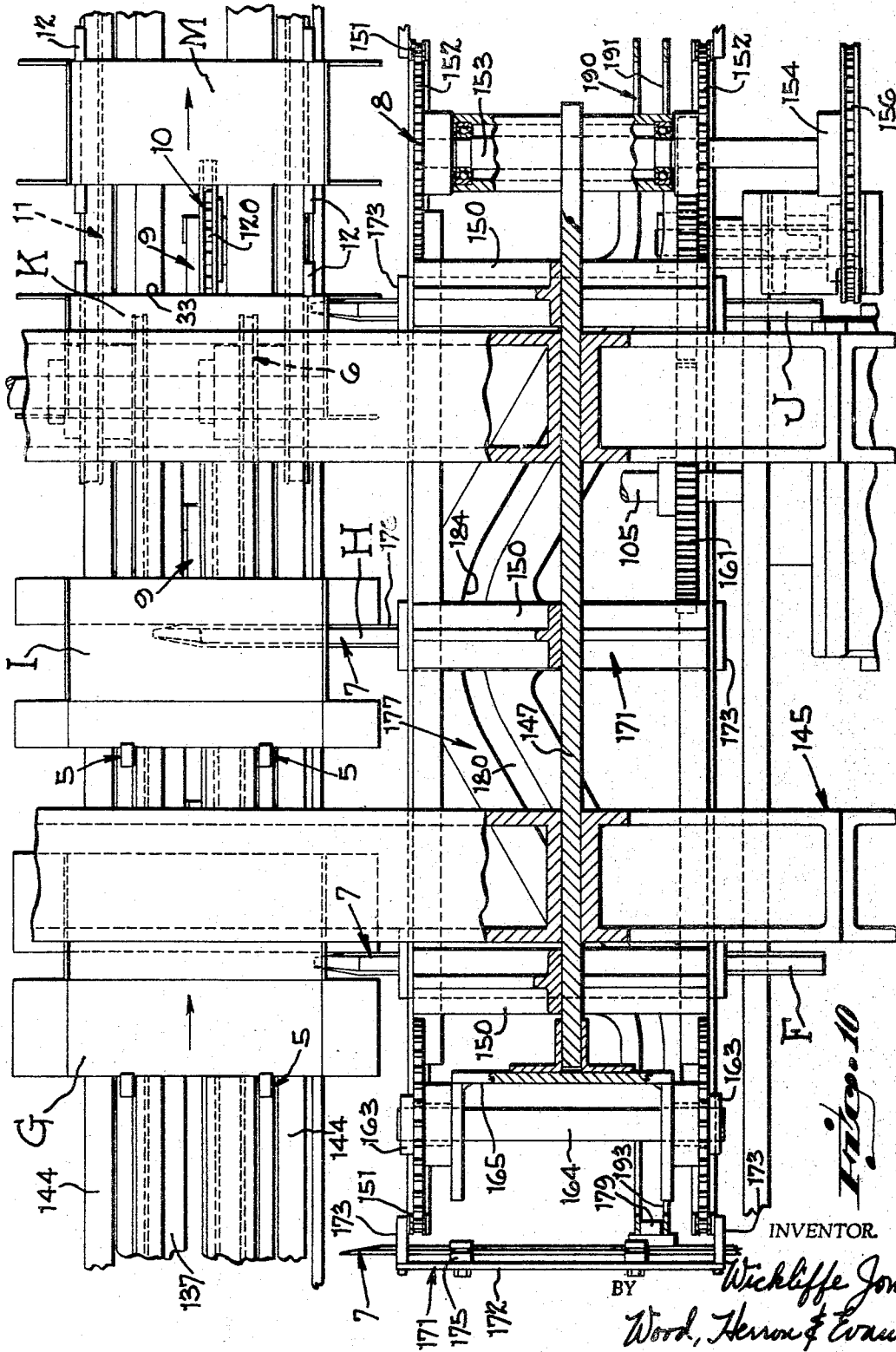
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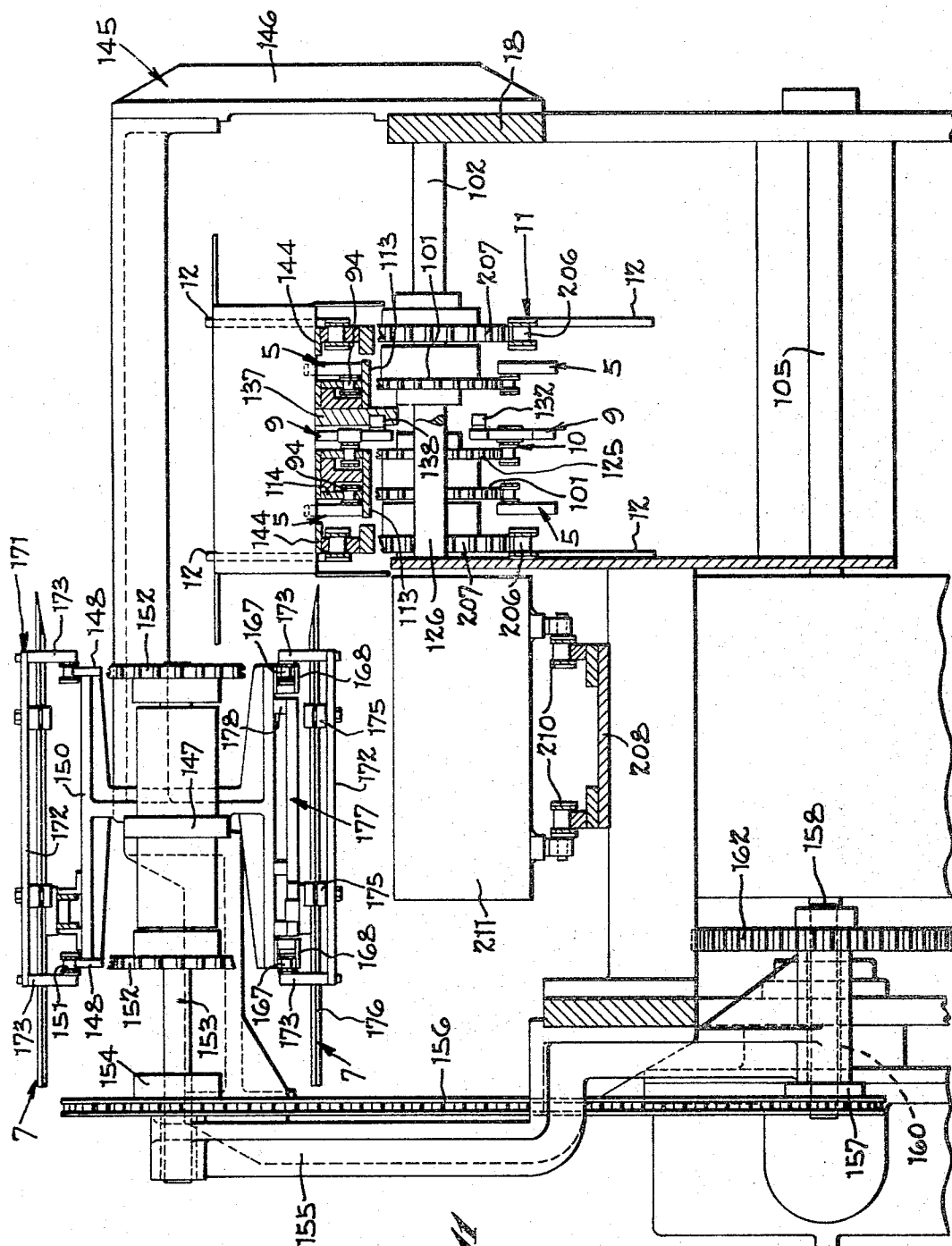
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PROGRESSIVE CARTON HANDLING MECHANISM FOR CARTONING MACHINES

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18 Sheets-Sheet 9



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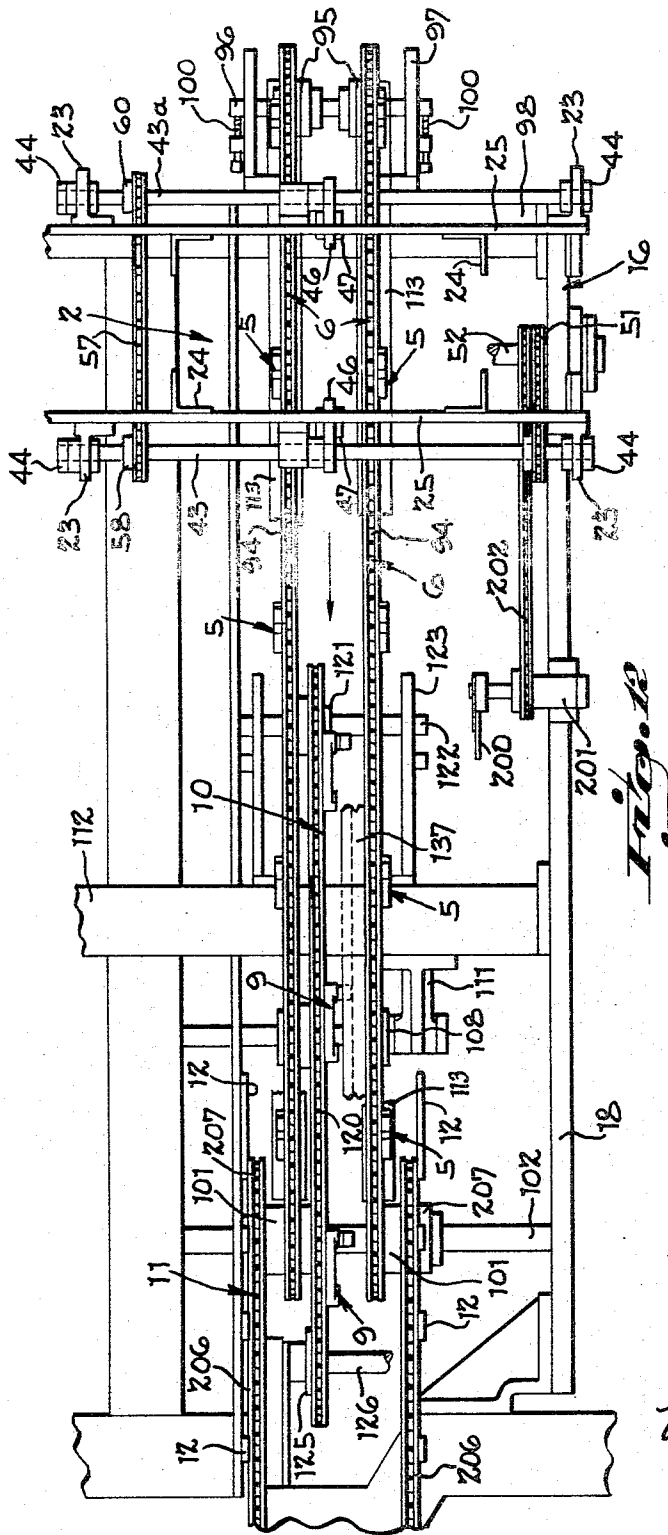
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Filed March 16, 1964

18 Sheets-Sheet 10



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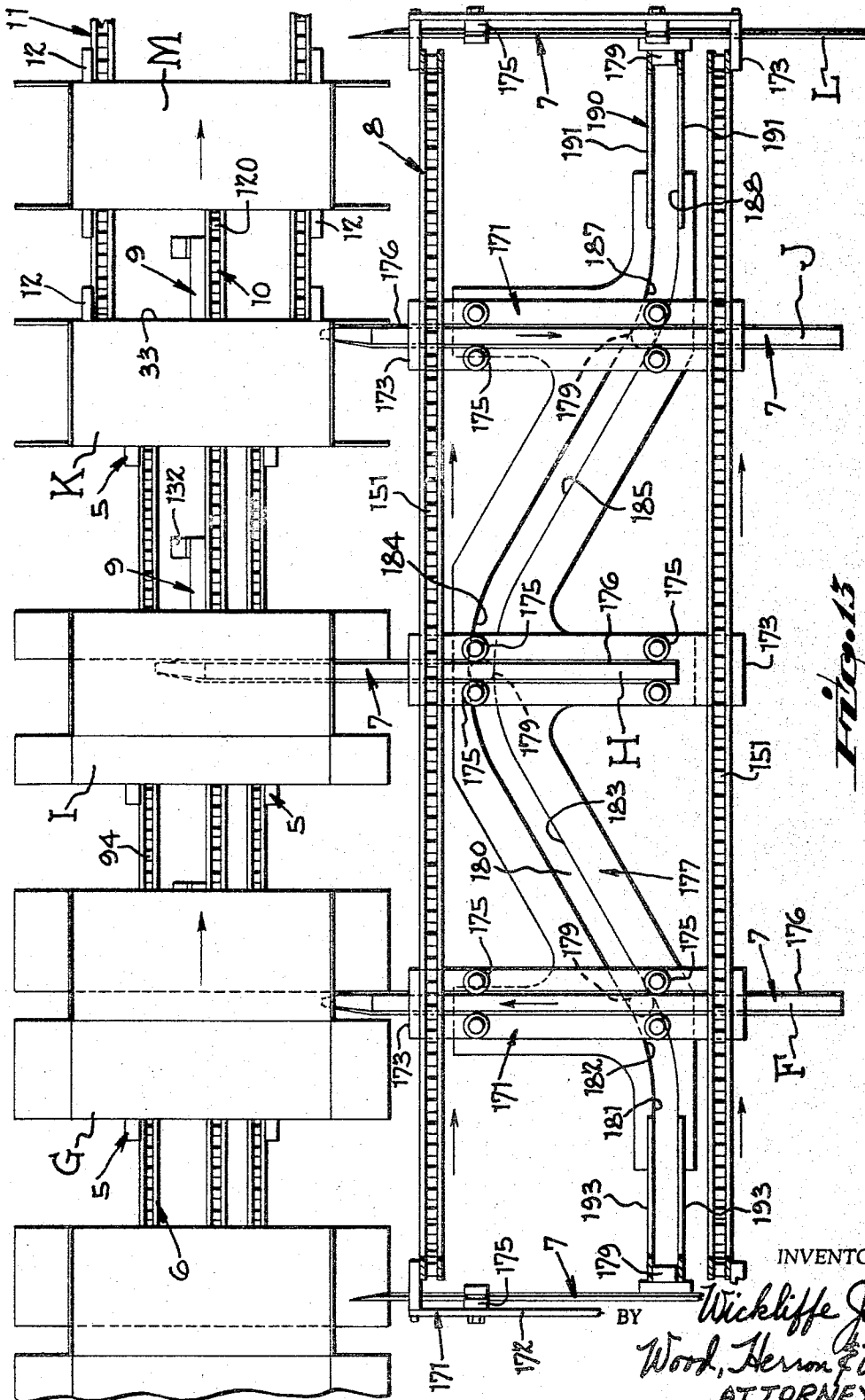
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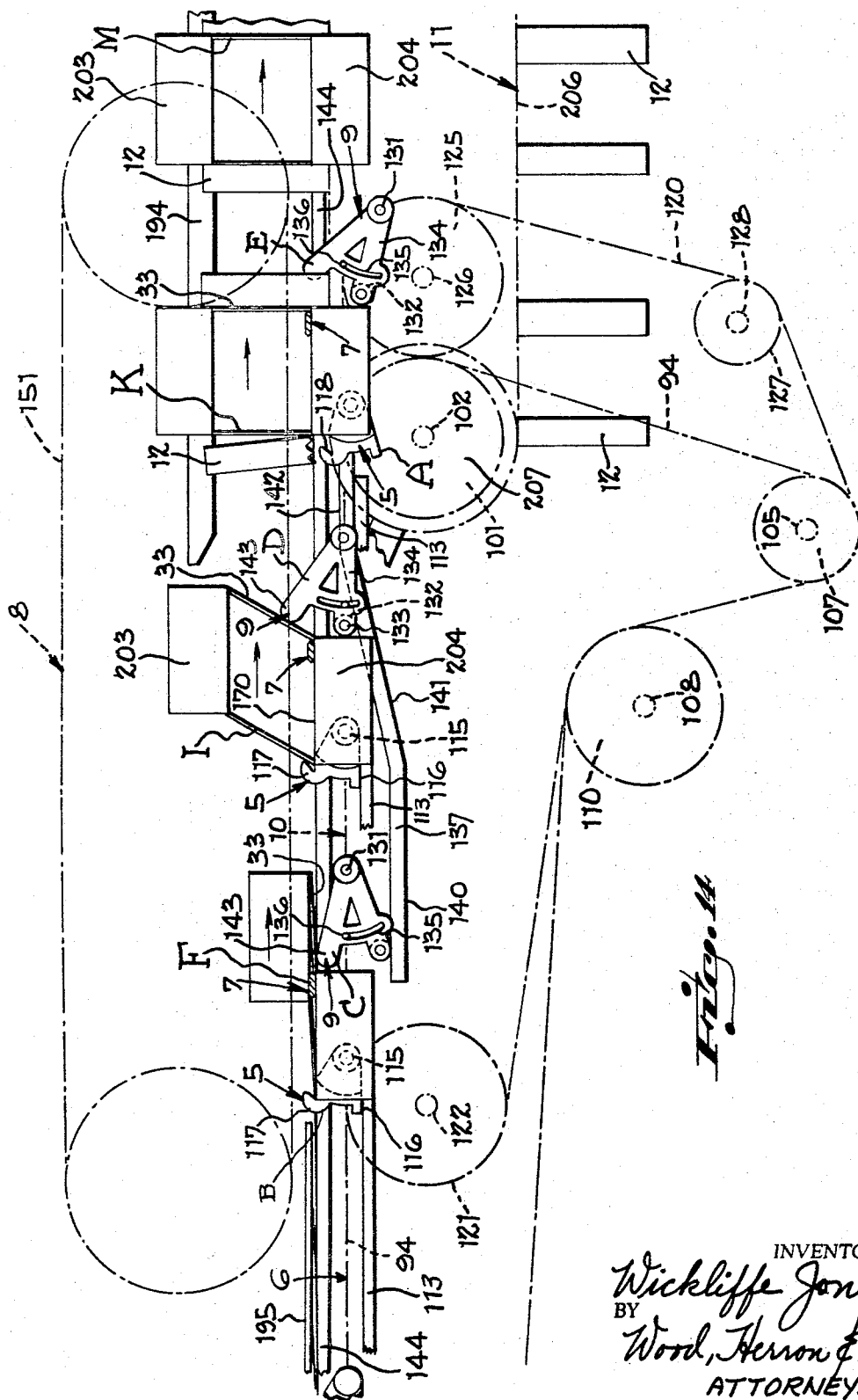


Fig. 12

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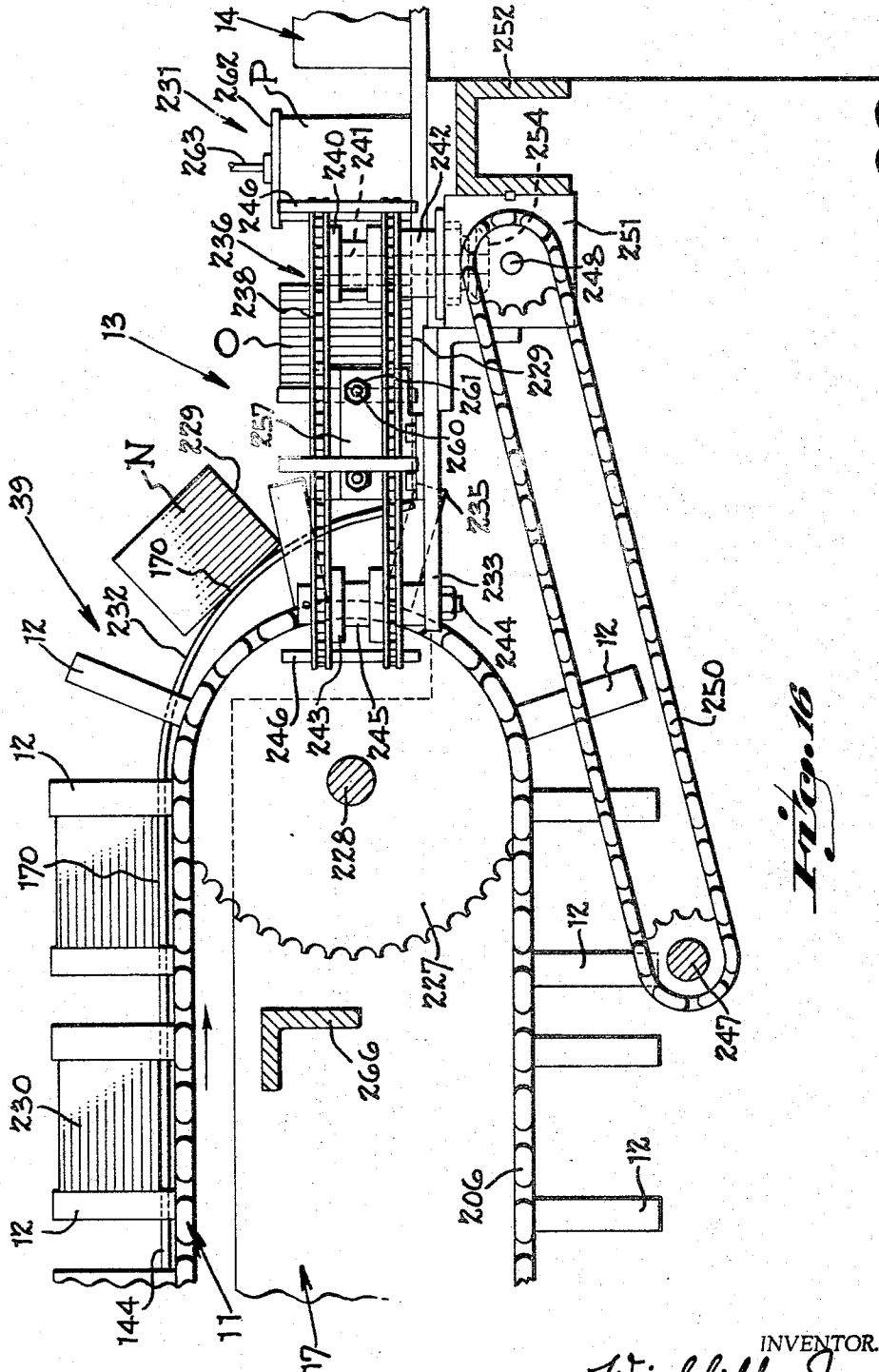
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18 Sheets-Sheet 14



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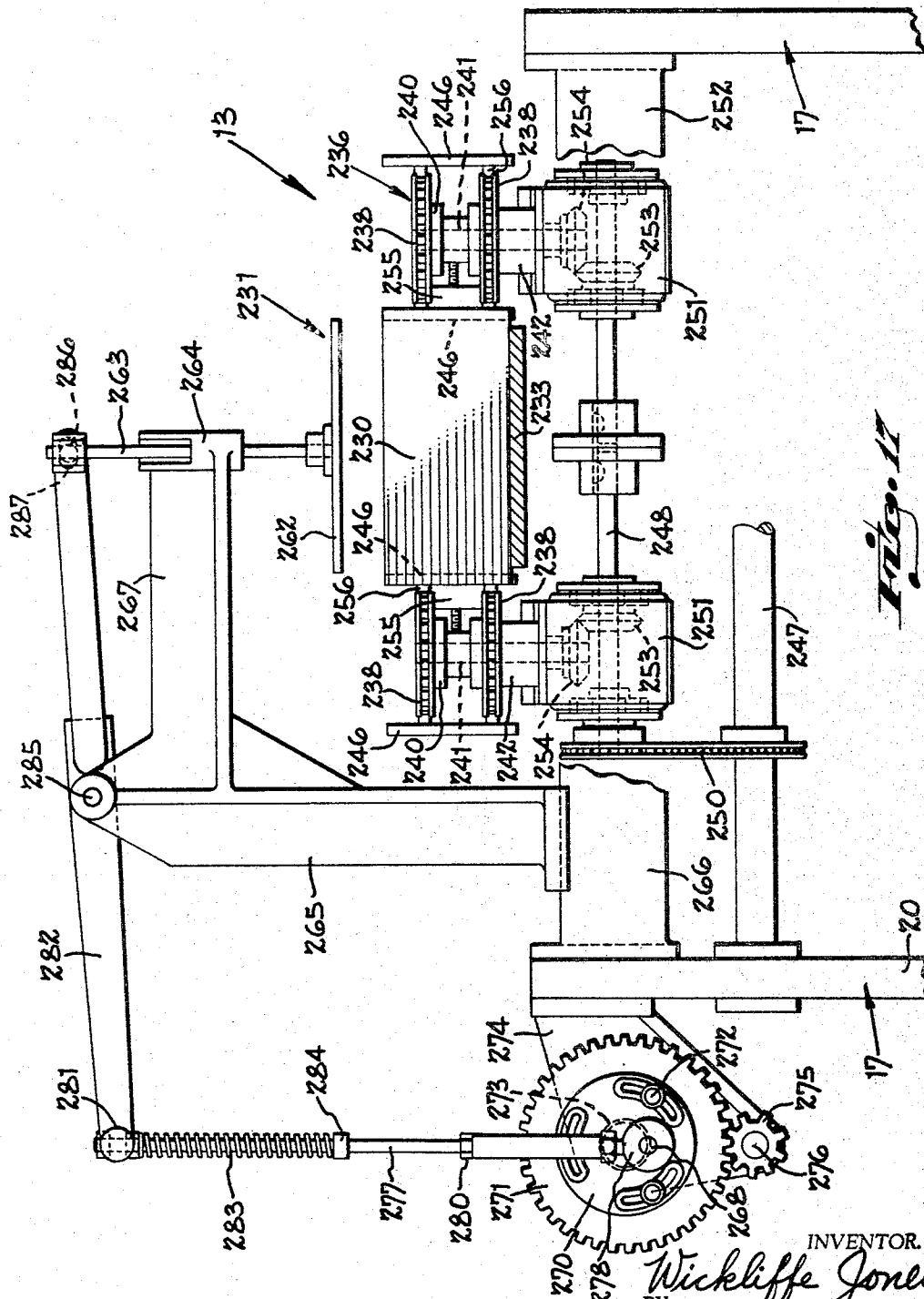


Fig. 17

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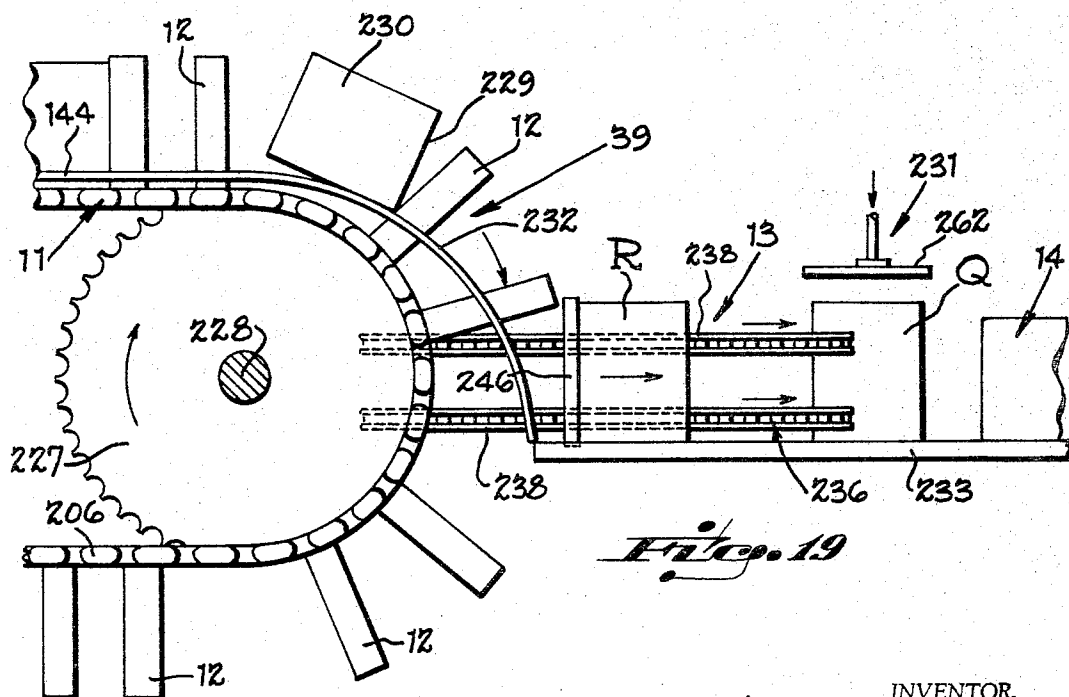
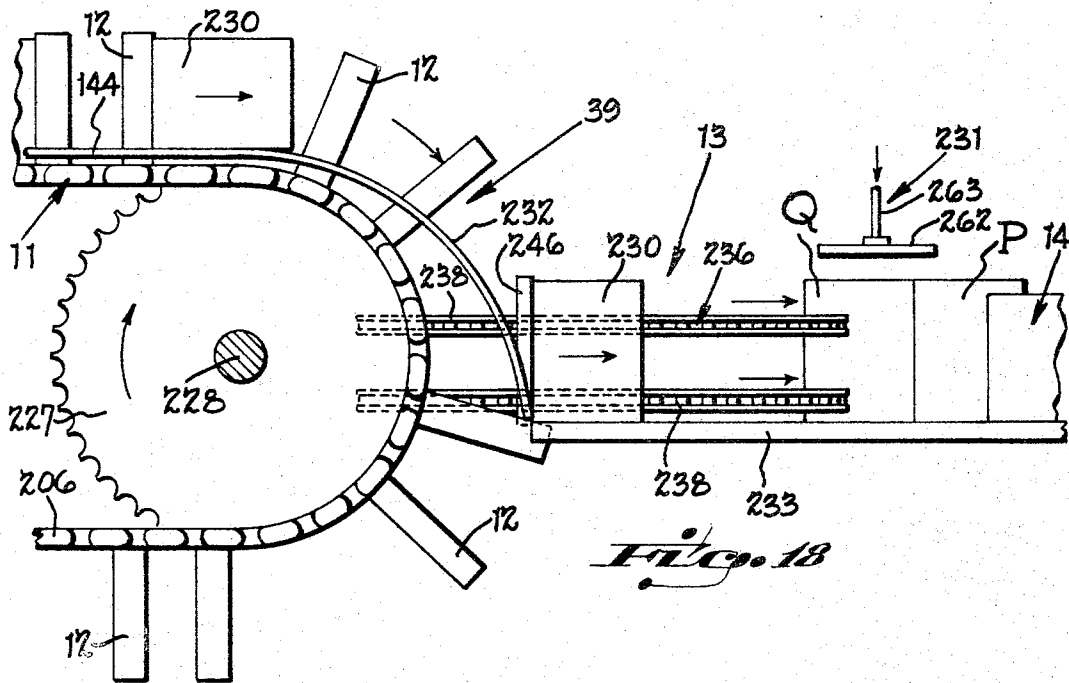
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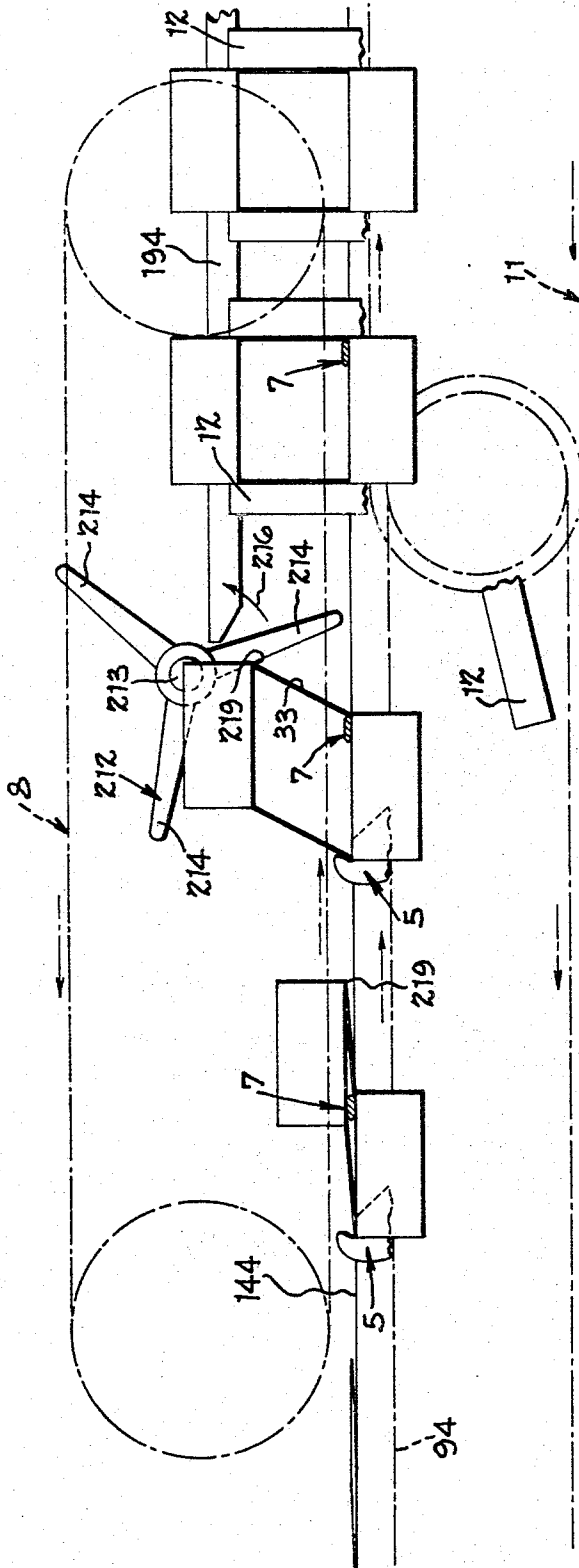


Fig. 20

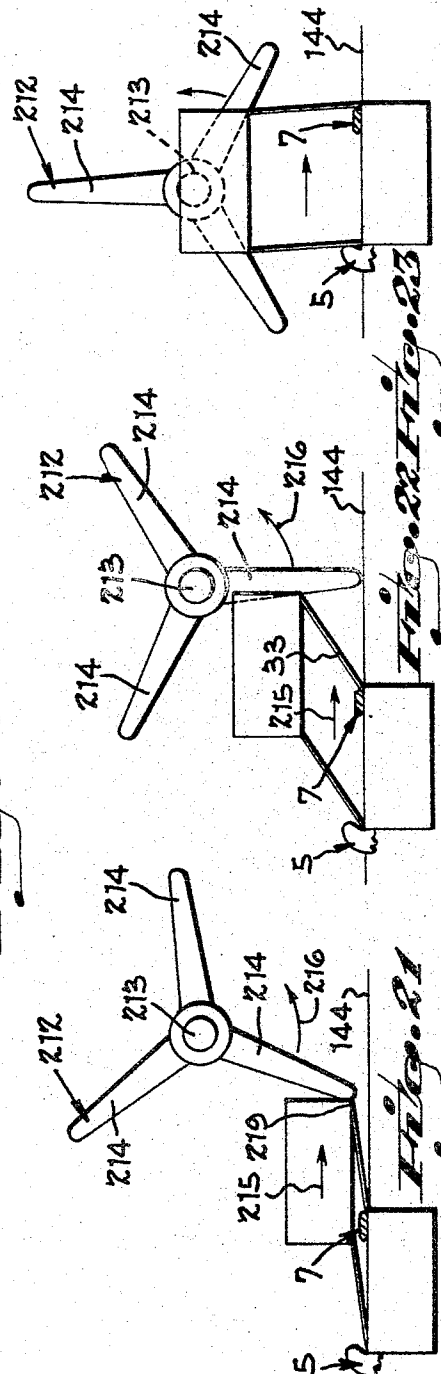


Fig. 21

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PROGRESSIVE CARTON HANDLING MECHANISM FOR CARTONING MACHINES

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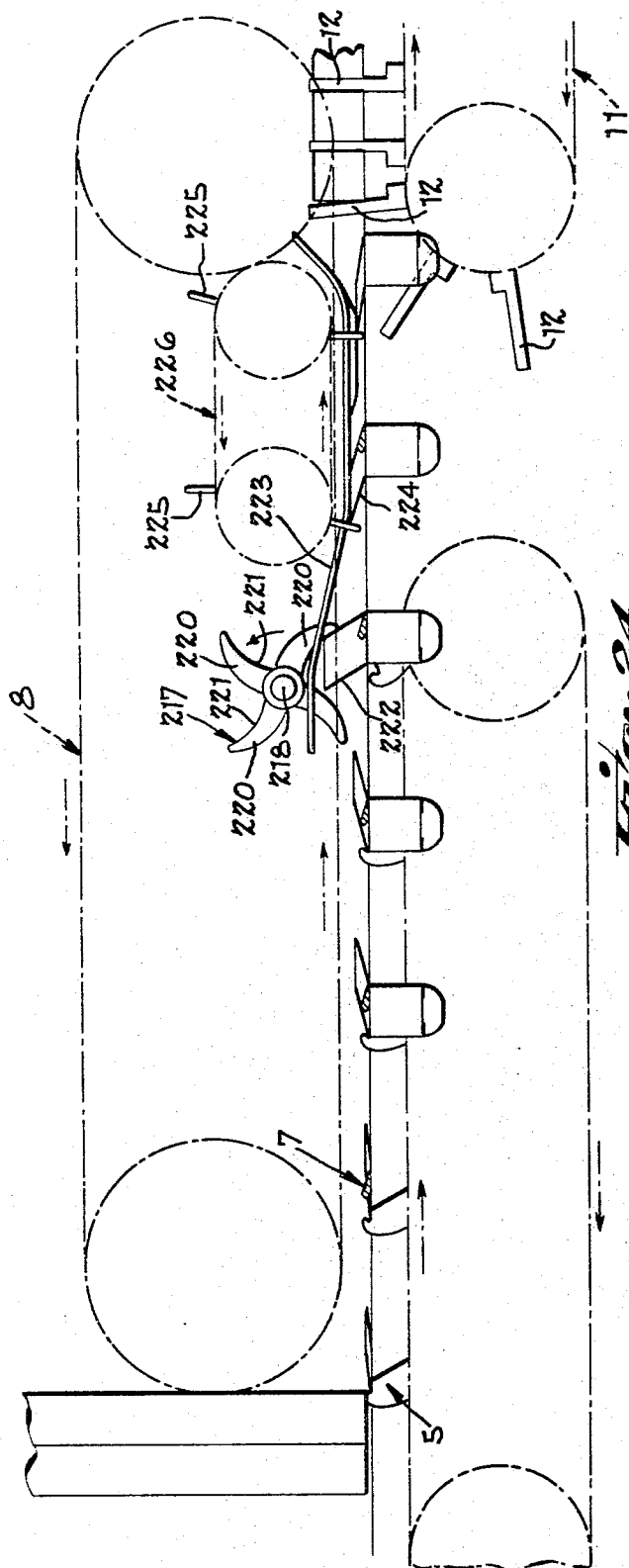


Fig. 24

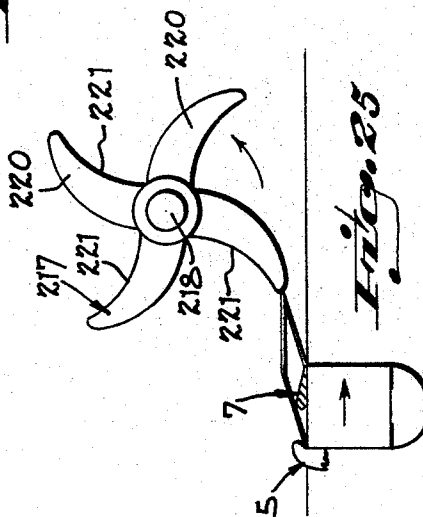


Fig. 25

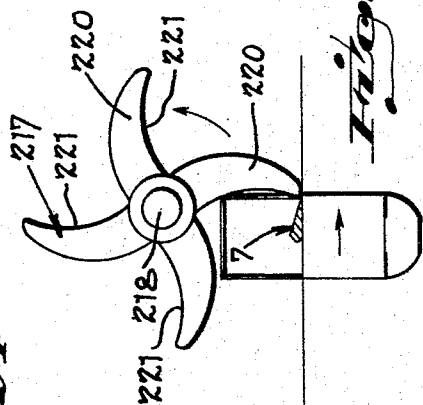


Fig. 26

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PROGRESSIVE CARTON HANDLING MECHANISM FOR CARTONING MACHINES

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Filed Mar. 16, 1964, Ser. No. 352,003

23 Claims. (Cl. 93—36)

This invention relates to carton handling mechanism for carton loading and sealing machines and particularly to a mechanism which ejects the cartons in flat collapsed condition from a magazine and which progressively erects and squares the cartons in a positive manner during continuous advancement of the cartons in stream formation toward and through the loading and sealing machine.

One of the primary objectives of the invention has been to provide a progressive erecting mechanism, utilizing traveling hold-down blades which are inserted transversely into the open ends of the flat collapsed cartons, the traveling blades coacting with other longitudinally moving elements to erect the cartons in a rapid positive manner during continuous advancement of the cartons.

The present progressive erecting mechanism includes, in general, a carton magazine arranged to confine the flat collapsed cartons in stack formation, and a carton ejection conveyor having ejection lugs traveling continuously in a longitudinal path beneath the magazine and arranged to eject the flat cartons individually from the lower end of the magazine. The traveling blade mechanism mentioned above, comprises a blade conveyor having individual hold-down blades which move bodily in the longitudinal direction in registry with and at the same speed as the collapsed cartons as they are ejected from the magazine. In addition, to the bodily longitudinal motion of the blades, each blade has a component of transverse motion, such that by virtue of the coordinated longitudinal and transverse motions, one of the blades is inserted endwisely into each collapsed traveling carton immediately after it is ejected from the magazine. The blade is arranged to hold the flat collapsed carton in a positive manner upon the support surface over which the carton slides as its trailing edge is engaged by the ejection lug to advance the collapsed carton.

In addition to the ejection conveyor, there is also provided an erection conveyor having spaced erection lugs which coact with the ejection lugs and traveling blades in erecting the carton. The erection lugs move in the same direction and at the same speed as the ejection lugs and traveling hold-down blades and are arranged to rise progressively from a retracted position so as to engage the leading side panel of each collapsed carton, the adjacent bottom panel being held down upon the support surface by the traveling blade. The flat carton is thus erected in parallelogram fashion (as viewed from the end of the carton) from the flat collapsed condition to its fully erected condition ready for loading.

Briefly therefore, the present erection mechanism takes advantage of the ejection lugs, not only to shift the collapsed carton in its own horizontal plane from the lower end of the magazine but also to assist in erecting the carton by advancing it in time with the traveling blades and erection lugs. In other words, the ejection lugs, traveling blades and erection lugs all cooperate with one another to provide rapid progressive erection of the continuously advancing cartons in a positive, reliable manner.

In the modified versions of the invention, which are included in the present disclosure, the erection lugs have been omitted; instead, the mechanism includes rotating star wheels which cooperate with the traveling blades and ejection lugs in erecting the cartons. In the modified versions, the star wheels are mounted above the ejection

conveyor in a position to cooperate with the ejection lugs and traveling blades to erect the carton, utilizing the same progressive erection principle outlined above. However, in the modified structure, the star wheel acts from above, upon the leading portion of each collapsed carton instead of acting from below, as disclosed with respect to the traveling erection lugs.

In the preferred embodiment which has been selected to illustrate the principles of the invention, the ejection conveyor comprises a pair of chain runs, each carrying respective pairs of ejection lugs which are transversely aligned with one another and arranged to engage the trailing edge of the bowed carton at the bottom of the magazine. The erection conveyor comprises a single erection conveyor chain located downstream from the ejection conveyor and having spaced erection lugs adapted to engage the leading side panel of the collapsed carton. The downstream portion of the ejection conveyor straddles an upstream portion of the erection conveyor, such that the trailing edge of the blank is engaged by the ejection lugs after withdrawal from the magazine for positive advancement while the leading side wall is acted upon by the erection lug, with the bottom panel of the traveling carton confined by the traveling hold-down blade.

The traveling blades are carried by an overhead conveyor which extends along the overlapping portions of the ejection and erection conveyors; this overhead blade conveyor includes a stationary cam adapted to insert and withdraw the traveling blades transversely in time with each advancing carton so as to cooperate with the ejection and erection lugs. After erection, each carton is transferred to a transport conveyor which carries the erected cartons through the loading and sealing machine.

The loading and sealing machine comprises a carton loading section, an adhesive section and a flap closing and sealing section and is arranged to complete the packaging operation as the cartons are advanced therethrough by the transport conveyor.

The broad idea of utilizing a transversely movable blade or spear in a carton erecting mechanism is disclosed in Patent 1,746,836, issued on Feb. 11, 1930, to the present assignee. However, the earlier patent does not suggest the present concept of progressive erection, wherein the blade travels longitudinally with the advancing carton. Instead, the earlier patent is directed to an intermittent motion machine, whereby the carton is moved in stepwise fashion during the erecting operation. The earlier patent also fails to suggest the principle of ejection lugs, traveling blades, and erection lugs, all coacting with one another in the progressive erection of the carton.

A further objective of the invention has been to provide an improved carton stack handling mechanism for the magazine which segregates the individual collapsed cartons from the stack in a rapid positive manner for engagement by the traveling ejector lugs, thereby to contribute to the rapid reliable operation of the carton erection mechanism.

Described briefly, the stack feeding mechanism comprises a reciprocating suction mechanism having suction mouthpieces engageable with the opposite end portions of the lowermost collapsed carton of the stack, combined with a set of carton retaining fingers normally engaging the opposite side edges of the collapsed carton to support the stack within the magazine. During the carton withdrawal, the suction mouthpieces engage the opposite end portions of the lowermost carton; the retaining fingers retract from the opposite side edges of the carton; then the suction mouthpieces descend. Immediately below the lower end of the magazine there is provided a pair of stationary rails which engage the mid-portion of the flat carton as it is withdrawn by the suction mouthpieces, thus causing the carton to be bowed downwardly across the

rails, with the end portions of the bowed carton disposed below the retaining fingers and in a plane to be engaged by the traveling ejection lugs.

When the flat carton reaches its bowed condition, the retaining fingers shift back to their retaining position beneath the end portions of the next flat collapsed carton of the stack; the suction mouthpieces release the bowed end portions of the flat carton at about the same time the ejection lugs engage the trailing edge of the carton. The flat carton is then shifted by the ejector lugs in its own horizontal plane from beneath the magazine for engagement by the traveling blade and subsequent erection, as explained above. By virtue of the coaction between the retaining fingers, stationary support rails, suction mouthpieces and ejection lugs, all of which operate in time with one another, the cartons are ejected in a highly reliable and speedy manner.

A further objective of the invention has been to provide a combined progressive erection and tamping mechanism which acts upon the cartons after they have been loaded, closed and discharged from the transport conveyor, the tamping mechanism being operable to square each carton before it is discharged.

According to this aspect of the invention, there is provided, at the downstream end of the transport conveyor, a curved discharge plate which rotates each loaded and closed carton about its longitudinal axis through a quarter turn in cascade formation and which deposits the carton upon a high speed conveyor with the carton resting upon one of its side walls. Downstream from the high speed conveyor, there is provided a reciprocating presser foot forming a part of the tamping mechanism. The presser foot descends in time with the other components of the machine so as to press the carton between its support surface and the presser foot momentarily, thereby to square the carton. The high speed conveyor is adapted to advance the cartons at a greater speed than the transport conveyor so as to provide the dwell period required by the tamping mechanism. After having been tamped, the carton is advanced to a drying conveyor which sets the adhesive before the loaded carton is discharged from the machine.

The various features and advantages of the invention will be more fully apparent to those skilled in the art from the following detailed description taken in conjunction with the drawings.

In the drawings:

FIGURE 1 is a fragmentary perspective view illustrating generally the carton magazine and the carton erecting mechanism which progressively erects the cartons as they are withdrawn from the magazine.

FIGURE 2 is an enlarged fragmentary perspective view detailing the carton withdrawal mechanism which is mounted below the magazine.

FIGURE 3 is an enlarged fragmentary perspective view showing the carton during transport from the magazine along the carton erecting chain runs and showing the traveling blade which forms a part of the carton erecting mechanism.

FIGURE 4 is a fragmentary side elevation illustrating, in a general way, the sprocket chain system of the carton withdrawal and erection mechanism.

FIGURE 5 is a fragmentary end elevation, as viewed along the line 5—5 of FIGURE 4, further illustrating the lower portion of the carton magazine and withdrawal mechanism.

FIGURE 6 is a fragmentary end view taken from FIGURE 5, illustrating the action of the suction cups and carton ejection lugs during withdrawal of the carton from the lower end of the magazine.

FIGURE 7 is a fragmentary sectional view taken along the line 7—7 of FIGURE 5, illustrating the cam and link mechanism which actuates the suction mouthpieces mounted at the lower end of the magazine as part of the carton withdrawal mechanism.

FIGURE 8 is a fragmentary sectional view taken along line 8—8 of FIGURE 5, further illustrating an actuating mechanism of the suction mouthpieces.

FIGURE 9 is a fragmentary side elevation, as viewed along line 9—9 of FIGURE 5, further illustrating the sprocket chain system of the traveling hold-down blades forming a part of the progressive carton erecting mechanism.

FIGURE 10 is a top plan, partially in section, taken along line 10—10 of FIGURE 9 further illustrating the arrangement of the traveling blades and other components of the carton erecting section.

FIGURE 11 is a sectional view taken along line 11—11 of FIGURE 9, further illustrating the progressive carton erecting mechanism.

FIGURE 12 is a top plan view of the carton feeding and progressive erection mechanism as viewed along line 12—12 of FIGURE 4.

FIGURE 13 is a fragmentary top plan as viewed along the line 13—13 of FIGURE 4 illustrating the progressive carton erection mechanism downstream from FIGURE 12, illustrating particularly the arrangement of the traveling blades which assist in the carton erection.

FIGURE 14 is a diagrammatic view, further illustrating the progressive carton erecting mechanism, including the traveling blades and coacting erection lugs as viewed from the side of the machine opposite to that shown in FIGURE 4.

FIGURE 15 is a fragmentary perspective view, illustrating the downstream end of the machine, particularly the discharge mechanism which turns and conveys the filled cartons from the machine to the tamping mechanism.

FIGURE 16 is a fragmentary longitudinal sectional view taken along line 16—16 of FIGURE 15, further illustrating the carton discharge mechanism.

FIGURE 17 is a fragmentary cross sectional view taken along the line 17—17 of FIGURE 15, further detailing the carton discharge and tamping apparatus.

FIGURES 18 and 19 are enlarged fragmentary diagrammatic views generally similar to FIGURE 16 and illustrating the operation of the carton tamping and discharge mechanism.

FIGURE 20 is a diagrammatic view illustrating a modified arrangement in which a rotating star wheel is utilized in place of the erection lugs for progressive carton erection.

FIGURES 21—23 are diagrammatic views illustrating the operation of the rotating star wheel in erecting the carton.

FIGURE 24 is a diagrammatic view showing a further modification of the star wheel arrangement.

FIGURES 25 and 26 are diagrammatic views illustrating the operation of the star wheel.

General arrangement

As explained above in general terms, the cartons which are handled by the present machine are of the end loading type, that is, the articles, such as the stacked tissue sheets, for which the machine is particularly intended, are fed into an open end of the carton after it is erected. In this particular type of carton, the end flaps are adhesively secured after the stack of sheets is inserted. The machine therefore includes flap handling mechanism, loading mechanism, means for applying liquid adhesive to the flaps, and means for folding the flaps to a closed position.

The invention is directed primarily to the mechanism for feeding and erecting the cartons progressively and also to the tamping mechanism which acts upon the opposite sides of the carton to square it before it is discharged from the machine.

The carton loading and sealing machine, which includes the flap handling mechanism, adhesive applying mechanism, loading mechanism, and flap closing mechanism,

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nism, outlined above, forms no part of the present invention. For the sake of simplicity therefore, the several components of the loading and sealing machine have been substantially omitted from the disclosure.

Referring to FIGURE 1, which illustrates the upstream end of the machine, the collapsed cartons, indicated generally at 1, are stored in stack formation in a carton magazine indicated generally at 2. A carton withdrawal mechanism, indicated generally at 3 is located at the lower end of the magazine 2 and, as explained later in detail, withdraws the collapsed cartons individually from the magazine for progressive erection. The initial withdrawal of the cartons is carried out by a suction cup mechanism, which is indicated generally at 4 (FIGURE 2).

As the endwise portions of the cartons are partially withdrawn by the suction cup mechanism 4 (FIGURES 2 and 6), the intermediate portion of the carton is engaged by the traveling ejection lugs, indicated generally at 5 (FIGURES 2 and 14) which are carried by a carton ejection conveyor, indicated generally at 6. The traveling lugs 5 engage the trailing edge of each carton so as to shift the carton from beneath the stack confined in the magazine for progressive erection.

After having been withdrawn from the lower end of the magazine 2, one of the traveling hold-down blades or spears, indicated generally at 7 (FIGURES 9 and 10), carried by the overhead conveyor 8, advances endwise between the walls of the collapsed carton so as to confine the collapsed carton upon its support surface, thereby to aid in the progressive erection. During continued advancement of the carton, one of the swinging erection lugs 9, carried by the erection conveyor 10 (FIGURES 10 and 12) engages the leading side panel of the carton and, in cooperation with the traveling blade 7, completes the erecting action.

After having been erected, each carton is transferred to the transport conveyor, which is indicated generally at 11 (FIGURES 10, 11, 15 and 16), to be carried through the carton loading and sealing machine, indicated generally at 19. The transport conveyor 11 includes fingers 12 which engage the opposite side walls of each erected carton to hold it in erected position during the loading operation.

As explained later in detail, the transport conveyor 11 includes means for holding the endwise flaps of the carton in open position during advancement of the carton through the loading and sealing machine 19. The loading and carton sealing machine 19 forms no part of the present invention; however, it will be understood that this mechanism is arranged to feed stacks of sheets, such as sheets of cleansing tissues in compacted condition into the open end of the carton, the opposite end flaps having previously been closed by a flap folding mechanism (not shown) which is located along the transport conveyor 11.

The loaded cartons thereafter are advanced to a carton discharge and tamping mechanism, which is indicated generally at 13 (FIGURES 15-19). This mechanism is located at the downstream end 39 of the transport conveyor 11. From the carton discharge and tamping mechanism 13, the loaded cartons are advanced to a heating conveyor 14, which applies heat and pressure to the flaps as the cartons advance, thereby to dry or set the adhesive.

The several mechanisms of the machine are mounted upon a rigid frame which is indicated generally at 15 (FIGURES 1 and 4). In the present disclosure, the frame is of sectional construction including a section 16 upon which is mounted the magazine and carton erecting mechanism and a section 17 which supports the transport conveyor and the loading and sealing machine 19. Each section includes horizontal beams 18 supported by legs 20 which support the machine components at an elevation convenient to the operator.

In order to drive the machine components in properly timed relationship with one another, a main drive shaft,

indicated generally at 21 (FIGURE 4), extends longitudinally along the lower portion of the frame and is rotatably journaled at suitable points in cross members or brackets for example, bracket 22—FIGURE 4. The main shaft is driven by a power motor (not shown) which includes a suitable reduction system, preferably of the variable speed type, in order to drive the machine components at the desired rate. A driving connection is established from the main drive shaft to the machine components by way of bevel gears as explained later.

Carton magazine and retaining fingers

Referring to FIGURES 2, 4-8 and 12 the carton magazine, previously indicated at 2, is supported at the upstream end of the machine upon a set of anchor brackets 23 which are attached to the first frame section 16. The magazine comprises a set of four angle members 24 having their lower ends attached to the cross beams 25-25 (FIGURE 12), the opposite ends of the beams being attached to the brackets 23. The stack of cartons 1 is rectangular, as viewed from above, the cartons are loosely confined by the angle irons 24 for individual withdrawal from the lower end of the magazine, which is open.

The cartons are confined in the lower end of the magazine by respective pairs of retainer fingers 26 (FIGURES 2 and 5) at opposite sides, the lower ends of which include angular projections 27. The projections face one another at opposite sides of the magazine and engage the lower end of the stack of cartons 1 (FIGURE 2) so as to support the stack in a positive manner. In order to separate the lowermost carton 30 from the stack (FIGURE 2), the retainer fingers 26 are shifted outwardly in time with the operation of the suction cup mechanism 4 to permit the end portions 28-28 of the lowermost carton 30 to be pulled downwardly from the lower end of the stack (FIGURE 6). During this portion of the cycle, the intermediate portion 31 of the transversely bowed carton is supported upon a pair of rails 32-32 which are mounted in a stationary position beneath the open end of the magazine. As viewed in FIGURE 2, the rails 32 are carried by angle brackets 29 which form a part of the conveyor frame, as explained later.

After the carton 30 is thus bowed, the traveling ejection lugs 5 engage the end portions 28 of the carton so as to shift the bowed carton in a horizontal plane from beneath the lower end of the magazine. After ejection, one of the traveling blades 7 shifts transversely into the open end of the collapsed carton (FIGURE 10) to partially erect the carton. Thereafter, one of the erection lugs 9 (FIGURE 14) engages the leading side panel 33 to complete the progressive erection of the carton as it advances toward the transport conveyor 11.

Described in detail, (FIGURES 2, 5 and 12), the retainer fingers 26 are mounted in respective pairs upon rock shafts 34-34 located at opposite sides of the magazine. Each rock shaft is journaled as at 35 between a pair of vertical bars 36 which are rigidly mounted upon the cross beams 25 of the magazine. Each rock shaft 34 includes a pin 37 projecting outwardly. A tension spring 38 has its lower end anchored as at 40 to the pin 37 and its upper end anchored as at 41 to a pin 42 projecting from the vertical bar 36. The tension spring 38 thus urges the retainer fingers inwardly in the stack retaining position, permitting the fingers 26 at opposite sides of the magazine to be retracted periodically for withdrawal of the lowermost carton, as explained below.

In order to retract and advance the retainer fingers 26 in time with the other components of the machine, the magazine includes a pair of actuating shafts 43 and 43a (FIGURE 12) for operating the respective pairs of retainer fingers 26 (FIGURES 2 and 5). The opposite ends of the cross shafts 43 and 43a are journaled in the brackets 23 of the magazine and are restrained axially by collars 44 embracing the opposite sides of the brackets. Each shaft 43 includes a cam 46 secured thereto (FIG-

URES 2 and 12) for imparting periodic oscillation to the rock shaft 34 and retainer fingers 26.

For this purpose, each rock shaft 34 includes an actuating lever 47 (FIGURE 2) secured to the rock shaft as at 48. A cam follower or roller 50 is journaled upon the lower end of actuating lever 47 and is in tracking engagement with the periphery of the cam 46. The cam permits the actuating lever 47 and the retainer fingers 26 to shift outwardly (by operation of tension spring 38) periodically in time with the other components of the machine.

It will be understood at this point, that the pairs of retaining fingers 26, the actuating shaft 43, the cam 46 and other components are duplicated at opposite sides of the magazine and that the two pairs of fingers are retracted and advanced concurrently. In order to provide this timing, the shafts 43 and 43a are rotated in unison by an upright sprocket chain run 51 (FIGURES 4, 5 and 12) which is driven from the longitudinal main shaft 21. For this purpose, there is provided a cross shaft 52 spanning and journaled in the legs 20—20 of the first frame section 16 (FIGURE 5). Rotary motion is imparted to the cross shaft 52 by a bevel gear 53 keyed to the main drive shaft 21; bevel gear 53 meshes with a bevel gear 54 which is keyed to the cross shaft 52.

Upright chain run 51, which drives the finger actuating shafts 43 and 43a, meshes with a lower sprocket 55 keyed to cross shaft 52 (FIGURE 4); the actuating shaft 43 includes a sprocket 56 in mesh with upright chain run 51.

In order to drive the companion actuating shaft 43a, there is provided an upper horizontal sprocket chain run 57 (FIGURES 4, 5 and 12). Chain run 57 meshes with the companion sprockets 58 and 60 keyed to the shafts 43 and 43a. The shafts 43 and 43a are thus rotated in unison with one another, their cams 46—46 being arranged to shift both pairs of retainer fingers 26 in time with one another.

Suction mechanism

As noted above, the suction mechanism 4 is arranged to bow the lowermost carton 30 of the stack transversely to permit engagement by the traveling ejection lugs 5 which shift the carton longitudinally in a horizontal plane from beneath the magazine for erection. It will be understood that the suction mechanism 4 operates in time with the ejection lugs 5, the several components being driven from the main shaft 21.

Described in detail, (FIGURES 2 and 5—8) the four suction cups or suction mouthpieces are mounted in pairs 61 and 62 (FIGURE 8) which are located transversely below the magazine 2. The mouthpieces are formed of rubber and are interconnected with a source of vacuum (not shown) by individual conduits 63 for each pair (FIGURE 2). Vacuum is applied to the four suction mouthpieces during the carton bowing operation and is relieved when the bowed end portions 28 are engaged by the ejection lugs 5. The application and release of vacuum is controlled by a cam and valve arrangement (not shown) which is also operated by the main shaft 21 in time with the other machine components.

The pairs of suction mouthpieces 61 and 62 are mounted for arcuate motion upon respective L-shaped levers 64—64 (FIGURES 5 and 6) which are oscillated in unison by respective cams as explained below. The levers 64 and their actuating mechanism is in duplicate and the following description applies to both. The L-shaped levers are mounted for oscillation upon a common shaft 65 having its opposite ends supported in a U-shaped bracket 66 (FIGURE 7). The U-shaped bracket 66 includes a mounting plate 67 which is secured by screws to a cross member 68 which forms a part of the first frame section 16.

During carton withdrawal motion, the L-shaped levers 64—64 swing downwardly through respective arcs from the position of FIGURE 5 to the position of FIGURE 6, the vacuum being applied to the suction mouthpieces dur-

ing this motion. As viewed in FIGURE 8 the inner end of each L-shaped lever 64 includes a hub 70 journaled on the shaft 65, the hubs being held in spaced relationship by the spacer collar 71 and the outer collars 72—72.

The vertical arm 73 of each L-shaped lever 64 includes a cross piece 74 (FIGURE 7) upon which is mounted the respective vacuum manifolds 75 and 76. Thus, as viewed in FIGURES 5 and 6, the suction mouthpieces 61—61 are mounted upon the manifold 75 and the suction cups 62—62 are mounted upon the manifold 76.

The manifolds are in the form of closed chambers; respective conduits 63—63 communicate with the interior of each manifold. The rubber suction mouthpieces 61 and 62 each include a metal nipple (not shown) having a bore communicating with the rubber portion of the cup. These nipples are threaded into the top wall of the respective manifolds 75 and 76 and provide communication with the interior of the manifold.

The pairs of suction cups are reciprocated by respective cams 77—77 (FIGURES 5 and 7), which are keyed to the cross shaft 52. Each cam has a track (not shown) which is configured to impart the oscillating motion to the L-shaped levers and their suction mouthpieces. The L-shaped levers are connected to the cams by push rods 78—78, each lever having an adjustable connector 80 at its upper end which is pivotally connected as at 81 to its L-shaped lever 64. The lower end of each push rod 78 includes a similar adjustable connector 82.

As viewed in FIGURE 7, the push rods are reciprocated by individual levers 83—83 which are pivotally connected as at 84 to a bracket 85 which is attached to a lower cross member 86 of the machine frame. Each lower adjustable connector 82 is pivotally connected as at 87 to the free end of its lever 83. Each lever 83 includes a cam follower in the form of a roller 88 which is journaled upon a pin 90 attached to the lever 83. Each roller 88 is loosely confined in the track of its cam in the usual way to impart the reciprocating motion to the lever 83 and push rod 78.

Since the cams 77 are keyed upon the cross shaft 52, which also drives the retainer fingers 26, the suction mouthpieces 61 and 62 are reciprocated in time with the fingers. In order to aid in supporting shaft 52 in the area of the cams and bevel gears, there is provided a bearing 91 (FIGURE 5), which is supported by a vertical bar 92 extending downwardly from the upper cross member 68. The outer ends of cross shaft 52 are journaled in bearings 93—93 (FIGURE 5), which are attached to the legs 20—20 of the frame, as explained earlier.

Carton ejection mechanism

As noted earlier, the cartons are ejected from the magazine by the ejection lugs 5 which are carried by the conveyor 6 (FIGURE 4), then the carton is acted upon by the traveling blades 7 and the erection lugs 9 which are carried by the erection conveyor 10. As the erection lugs 9 begin to act upon the carton, one of the traveling blades or spears 7 of the overhead conveyor 8 passes into the open end of the carton to assist in the progressive ejection.

As shown in FIGURES 4 and 12, the ejection conveyor 6 comprises a pair of parallel chain runs 94—94 passing beneath the magazine 2. At the upstream end of the machine, the chain runs pass about a pair of idler sprockets 95—95 which are carried upon an idler shaft 96. The idler shaft 96 has its opposite ends adjustably confined in a U-shaped bracket 97 which is mounted on the cross member 98 which forms a part of the first frame section 16. The bracket 97 includes the usual adjustment screws 100 engaging the opposite end portions of the idler shaft in order to adjust the tension of the chain runs 94.

The downstream end of the ejection chain runs 94—94 pass about a second pair of sprockets 101 (FIGURES

4-11 and 12) which are keyed to a drive shaft 102. The drive shaft 102 is journaled in bearings (not shown) which are secured to the longitudinal members 18 of the first frame section 16. The cross shaft 102 also drives the transport conveyor 11, as explained later.

As best shown in FIGURE 4, power is transmitted from the main drive shaft 21 to the chain runs 94 by means of a bevel gear 103 fixed to a main shaft 21 and meshing with a bevel gear 104 which is keyed to a cross shaft 105. The bevel gears 103 and 104 are similar to the bevel gears 53 and 54 described earlier with reference to FIGURE 5. The cross shaft 105, in a similar manner, is journaled in bearings, similar to bearings 93, which are mounted upon the legs 20 of frame section 16. Since the cross shaft 105 extends at right angles across the main drive shaft 21, the drive shaft is interrupted; the drive is completed to the upstream section of the drive shaft 21 by a second bevel gear 106 (FIGURE 4) meshing with the bevel gear 104 of cross shaft 105.

The chain runs 94—94 of carton ejection conveyor 6 are in direct driving connection with the power cross shaft 105. For this purpose, there is provided a pair of sprockets 107 (FIGURE 4) keyed to the cross shaft 105. After passing around the sprockets 101 of cross shaft 102, the chain runs 94 pass downwardly and mesh with the sprockets 107—107. The chain runs 94 then pass upwardly and mesh with a pair of idler sprockets 108—108 (FIGURES 4 and 12) mounted on an idler shaft 110. The idler shaft 110 has its opposite ends supported by bearing brackets 111—111 which are attached to a cross member 112. During operation of the machine the chain runs 94 of the carton ejection conveyor 6 advance the ejection lugs 5 in the direction indicated by the arrows in FIGURES 4 and 12.

The upper runs 94—94 of the ejection conveyor are supported upon support rails 113—113 (FIGURES 2, 5, 6 and 11). The rails are supported upon the cross members of the machine frame. In order to hold the chain runs accurately in the horizontal plane, each support rail includes a hold-down rail 114, the lower edge of which loosely engages the rollers of the chain (FIGURES 2, 5 and 6). The hold-down rails 114—114 are supported by the angle brackets 29 which are located at spaced intervals along the support rail 113 for this purpose. The support rails 113 and hold-down rails 114 extend for substantially the full length of the ejection conveyor and terminate at the sprockets 95 and 101.

As noted earlier, the ejection lugs 5 are arranged in pairs and are pivotally connected as at 115 to the chain runs 94—94 (FIGURES 4 and 14). The pairs of ejector lugs are spaced apart along the chain runs 94 as indicated in FIGURE 14. As viewed from the side (FIGURES 4 and 14), the ejector lugs are generally triangular in configuration. The lower surface of each lug is provided with a flat 116 (FIGURES 2 and 14). The flats 116 of the lugs form a bearing surface slidably engaging the support rails 113 (FIGURE 14) so as to hold the lug in the elevated carton-engaging position as the lugs pass beneath the magazine.

The upper edge of each lug has a head portion 117 which is notched as at 118 for engagement with the edge of the collapsed carton 30. Upon reaching the end of the support rails 113 adjacent the sprockets 101, the lugs pivot downwardly to a retracted position (note lug A—FIGURE 14). The lugs remain in this position until they pass around the idler sprockets 95. At this point the flat bearing surface 116 engages the end of its rail 113 and is shifted back to the upright position as indicated at B in FIGURE 14.

Carton erection mechanism

The carton erecting conveyor 10 (FIGURES 4, 10-14) comprises a single chain run 120 interposed between and overlapping the ejection chain runs 94—94 (FIGURE 12). As noted earlier, the ejection lugs 5 coast with the

erection lugs 9 and with the traveling hold-down blades 7 in erecting the carton. The erecting operation occurs along the overlapping portion of the two chain runs 94 and 120 as shown in FIGURES 12 and 14. It will be noted in these views that the overhead blade conveyor 8 extends along the overlapping portion of the chain runs 94 and 120.

As shown in FIGURES 4 and 12, the upstream end of the erection chain run 120 passes around an idler sprocket 121 which is mounted on an idler shaft 122, the shaft being mounted in a U-shaped bracket 123. The U-shaped bracket is attached to the cross member 112 (noted earlier) and its projecting portion is slotted as at 124 to receive the idler shaft 122. Slot 124 permits adjustment of the shaft to control the tension of the chain run 120 in the manner previously described.

The downstream end of the erection chain run 120 passes over a sprocket 125 which is keyed to a cross shaft 126 (FIGURES 4, 11 and 12). From the sprocket 125, erection chain run 120 passes downwardly about an idler sprocket 127 carried on a shaft 128 of bracket 130 (FIGURE 4). After passing about the idler sprocket 127, the chain run 120 passes around a drive sprocket (not shown) which is keyed on cross shaft 105. This sprocket is a duplicate of the sprockets 107—107 and is located on the common cross shaft 105 between the sprockets 107. After passing around the drive sprocket, chain run 120 passes around an idler sprocket (not shown) which is a duplicate of the idler sprockets 108—108. This idler sprocket is mounted upon the cross shaft 110 between the sprockets 108—108 from the idler sprocket, chain run 120 passes upwardly around the idler sprocket 121, previously described. Since the chain runs 94—94 and 120 are both driven by the cross shaft 105, the runs are driven in the same direction, as indicated by the arrow and at the same speed.

As viewed from the side (FIGURES 4 and 14), the erection lugs 9 are generally triangular in shape and are pivotally connected as at 131 to the chain run 120. The erection lugs are located along chain run 120 at a spacing corresponding to the ejection lugs 5. The lugs 5 and 9 are spaced apart from one another a distance corresponding to the size of the carton so as to coast with one another during the erecting motion. As viewed in FIGURE 10, the pair of ejection lugs 5 engage the trailing edge of the carton while the companion erection lug 9 engages the leading edge of the carton and rises from a retracted position to an extended position as each set of coasting lugs advance in a downstream direction (FIGURE 14).

In order to progressively elevate the advancing erection lugs, each lug 9 is provided with a roller 132 which is journaled as at 133 to the lower leg 134 of the lug (FIGURES 11 and 14). In order to prevent overtraveling, each erection lug 9 includes an arcuate slot 135 which is traversed by a pin 136 projecting from the chain 120. The rollers 132, during advancement of the lugs along the upper run of chain 120, enters a slot 138 formed in a longitudinal cam plate 137 (FIGURE 11). The cam plate 137 extends between the sprockets 121 and 125 of the erection chain run 120 to control the progressive upward motion of the erection lugs 9.

As shown diagrammatically in FIGURE 14 the slot of cam track 137 comprises a lower horizontal section 140, an upwardly inclined section 141 and an elevated horizontal section 142. Thus, as the erection lug advances in the downstream direction, around sprocket 121 to the upper run of the chain, its roller 132 enters the slot and traverses the lower horizontal section 140, such that the upper arm 143 of the lug resides below the leading side panel 33 (FIGURE 14) of the partially collapsed carton. This lug is indicated at C in FIGURE 14. During continued advancement, and after the blade 7 passes into the carton, the roller 132 traverses the inclined portion 141, thus progressively elevating the lug 9 as indicated at

D (FIGURE 14) to erect the carton in cooperation with the ejection lug 5, while the carton is held down by the traveling blade 7. When the erection lug reaches the sprocket 125, as indicated at E, the roller 132 reaches the end of the upper section 142, allowing the erection lug to drop to a retracted position for advancement about the return run of erection chain 120.

Traveling blade mechanism

As the cartons are progressively erected by the ejection and erection lugs, the carton is slidably supported upon a pair of longitudinal rails 144—144 (FIGURES 10 and 14) which extend in the downstream direction from the magazine 2 toward and through the transport conveyor 11. These rails sustain the carton at the proper elevation to permit the traveling hold-down blades 7 to enter the carton and hold its bottom panel against the rails 144, while the side panels are being acted upon by the lugs 5 and 9. The blades 7 progressively pass into the cartons and are withdrawn as the carton, fully erected and squared enters the transport conveyor 11 (FIGURE 14). At this point in the cycle, the erection lug E retracts from the carton side panel, the panel now being engaged against one of the transport fingers 12 of the transport conveyor, as described later.

Described in detail, the carton support rails, indicated at 144—144 (FIGURES 10 and 11) are located alongside the ejection lugs 5—5 and are supported in the usual manner upon the frame of the machine. As viewed in FIGURE 10, the overhead conveyor 8, which advances the traveling blades 7 is mounted to one side of the ejection and erection chain runs.

Described in detail (FIGURES 9, 10, 11 and 13), the overhead conveyor 8 comprises a frame indicated generally at 145 which is supported by vertical brackets 146 rising from the frame section 16. The frame 145 comprises a plate 147 (FIGURE 10) attached to the upper ends of the brackets 146. The upper chain runs of the overhead conveyor are supported upon horizontal rails 148—148. The rails 148 are supported by a series of brackets 150 which are generally I-shaped, as viewed in FIGURE 11. The brackets 150 also support the plate 147.

The traveling hold-down blades 7 are supported and advanced by a pair of chain runs 151—151 (FIGURES 9 and 13), the upper runs being supported upon the rails 148, as noted above. The chain runs are advanced by a pair of driving sprockets 152—152 (FIGURES 4, 9 and 11) which are keyed to a cross shaft 153. The shaft 153 includes a power sprocket 154 (FIGURE 11). The cross shaft 153 has one end journaled in a vertical bracket 155 and its opposite end is journaled in the plate 147 and extends outwardly to carry the second sprocket 152. The chain runs are driven by a sprocket chain 156 passing about a sprocket 157 keyed to a drive shaft 158 (FIGURES 4, 9 and 11). Shaft 158 is journaled in a sleeve 160 formed at the lower end of bracket 155.

Power is transmitted from the main shaft 21 by the gear 161 which is keyed to the cross shaft 105 and meshing with a gear 162 which is keyed to the shaft 158 (FIGURES 4 and 9). As noted earlier, the cross shaft 105 is driven from main power shaft 21 by the bevel bears 103 and 106. The chain runs 151 are thus advanced in time with the other components of the carton erecting and ejecting mechanism. The opposite end of the chain runs 151 are trained about idler sprockets 163—163 mounted on a shaft 164 (FIGURES 9 and 10). Shaft 164 is journaled in a bearing bracket 165 which is attached to the end of support plate 147. The bearing bracket 165 is slotted as at 166 and includes conventional adjustment means engaging shaft 164 to control the tension of the chain runs.

It will be understood at this point, that the traveling blades 7 act upon the carton during advancement of the blades along the lower chain runs 167—167 (FIG-

URES 4, 9 and 11). The lower chain runs 167 pass along chain support rails 168 which are mounted upon the lower arms of the brackets 150 (FIGURES 9 and 11). This arrangement supports the blades 7 at a plane which coincides with the bottom panel of the carton (FIGURE 14).

The traveling blades 7 are mounted in individual slide brackets 171 which are located along the chain runs at spacing corresponding to the lugs 5 and 9 (FIGURES 9, 10, 11 and 13). Each slide bracket 171 comprises a bar 172 extending transversely across the chain runs 151—151, the opposite ends of each bar 172 being supported by pairs of lugs 173 projecting outwardly from the chain runs. Each pair of lugs includes openings 174 (FIGURE 9) through which the opposite ends of the traveling blade 7 project.

Each blade 7 is mounted for shifting motion between respective pairs of rollers 175—175 (FIGURES 11 and 13) which are pivotally mounted on the cross bar 172. The opposite side edges of each blade is chamfered as at 176, the chamfered edges interfitting the grooves of the rollers 175 to support the blade for axial motion.

Axial motion is imparted to the traveling blades 7 by a stationary bar-type cam 177 (FIGURE 13). As viewed in FIGURE 11, stationary cam bar 177 is connected by spacers 178 to the lower limbs of the I-shaped brackets 150. The stationary cam bar 177 is configured to advance and retract the blades in timed relation as the blades travel with the cartons during erection (FIGURE 13).

For this purpose, each blade 7 includes a cam roller 179 which is confined in an open slot forming a cam track 180 in the upper surface of the stationary cam bar 177 (FIGURE 13). At the upstream end of the stationary cam bar 177, the cam track 180 includes a section 181 which is parallel with the chain runs and which leads to a curved track section 182 blending into a forwardly inclined section 183. The inclined section 183 advances the blade 7 into the open end of the carton, as indicated by the arrow. This blade is indicated at F (FIGURES 10, 13 and 14), the carton G being in its flat collapsed condition at this point.

Upon reaching the downstream end of inclined section 183, the cam roller traverses a second curved section 184 (FIGURE 13). At this point the blade 7 is in its fully extended position and the carton is partially erected. The fully extended blade is indicated at H and the partially erected carton is indicated at I (FIGURES 13 and 14). During advancement beyond the curved section 184, the cam roller advances along the rearwardly inclined section 185, thereby progressively retracting the blade from the carton, while the ejection and erection lugs 5 and 9 complete the erection. The retracting blade is indicated at J and the erected carton is indicated at K (FIGURES 13 and 14). At this point, the leading side wall 33 of the carton is engaged by the transport fingers 12 of the transport conveyor 11.

The blade J is fully retracted during advancement of its cam roller beyond the curved section 187 (FIGURE 13), as indicated by the arrow, and continues along the parallel section 188 in its fully retracted position. The blade in its fully retracted position is indicated at L and the erected carton is indicated at M.

Upon advancing through the straight track section 188, the cam roller 179 enters a return track 190 (FIGURE 13) comprising a pair of parallel rails 191—191 attached to the end portion of parallel track section 188. The return track 190 resides in a single plane and follows the path of the cam rollers 179 about their path of motion upwardly around the sprocket 152 (FIGURE 9), along the top run 151 of the chains and downwardly as the cam rollers pass around the sprockets 163 at the upstream end.

The parallel section of the return track is indicated generally at 193 (FIGURES 9, 11 and 13), the track section being supported upon the upper portion of the I-

shaped brackets 150. At the upstream end, the return track 190 communicates with the parallel track section 181. By virtue of this arrangement, the cam rollers 179 are confined throughout their path of travel so as to hold the blades in the retracted position during their return motion along the top run 151 of the chains.

As the flat collapsed cartons are ejected from the magazine 2 (carton G—FIGURE 13) they are confined beneath a pair of bars 195—195 (FIGURES 1 and 14). These bars prevent the carton from buckling during ejection and terminate at the point where the erection lugs 9 begin to act upon the cartons.

During progressive advancement and erection of the cartons along the traveling blade conveyor 8, but before the walls are completely erected (carton I—FIGURES 14 and 15), the cartons pass beneath a pair of hold-down bars 194 which slidably engage the upper wall of the cartons (FIGURES 1 and 14). These rails are suitably supported and extend through the transport conveyor 11, such that the cartons are held in erect squared condition between the pairs of transport fingers 12 on opposite sides and between the lower rails 144 and top rails 194 (FIGURES 1, 11 and 14). The cartons are thus held in squared condition during advancement through the transport conveyor 11 for the loading, flap closing and sealing operations, which are carried out by the loading and sealing machine 19. As noted earlier, the loading and sealing machine forms no part of the present invention and therefore has not been disclosed in detail.

As viewed in FIGURE 1, the flaps 196 on the closed end of the carton (opposite the traveling blade mechanism 8) are shifted to closed position upon encountering the flap rail 197, the trailing flaps 198 remaining in open position subsequently to be folded after adhesive is applied during passage through the loading and sealing machine 19 by the transport conveyor 11.

As shown in FIGURES 1 and 4, a rotating flap finger 200 is mounted along the side of the machine opposite the traveling knives to act upon the closed end of the carton. The rotating finger 200 is mounted upon a bracket 201 and is driven from the cross shaft 52 by a sprocket and chain drive 202. The finger 200 acts upon the top flap 203 (FIGURE 14) after the collapsed carton is ejected from the magazine. The lower flap 204 (FIGURE 1), at this end of the carton is engaged by a rail 205 and held in its open position as it passes into the transport conveyor 11. It will be understood that the flaps at this end of the carton are folded and closed before the loading operation, while the open end of the carton which is acted upon by the traveling blade mechanism 8 includes similar flaps which remain open until after the carton is loaded.

Suitable flap handling apparatus (not shown) for the open or loading end of the carton, is mounted along the traveling blade mechanism. This mechanism is arranged to hold the flaps in open position to prevent interference with the traveling knives during erection. After erection, the flaps at this end of the carton are engaged by suitable flap handling mechanism (not shown) to hold the flaps in open position for loading.

As shown in FIGURES 11, 12 and 14, the transport fingers 12 are mounted at properly spaced intervals upon the two transport chain runs 206—206. The chain runs 206 are trained about sprockets 207—207 which are keyed to the power shaft 102 (FIGURES 12 and 14). The fingers 12 assume radial positions as they pass around the sprocket 207 to permit entry of the erected carton K. Subsequently the fingers 12 move to their vertical positions to embrace the carton for advancement along the transport conveyor and through the carton loading and sealing machine 19.

In order to load the carton, there is provided an article conveyor 208 (FIGURE 11) comprising two chain runs 210—210 supporting respective buckets 211. These buckets include open ends and are advanced in registry with the open ends of the cartons as they advance on transport conveyor 11. At the loading station (not shown) of cartoning machine 19 a loading mechanism shifts the stack

of tissues into the open end of the carton; thereafter adhesive is applied to the flaps and the flaps are folded to closed position. The carton then advances to the discharge and tamping section of the machine as described later.

Modified carton erection mechanism

A modified carton erecting mechanism, utilizing the principle of progressive erection with the use of the traveling blades and ejection lugs is disclosed diagrammatically in FIGURES 20—23. This structure utilizes the same overhead blade conveyor 8 and the stationary cam arrangement (stationary cam 177—not shown in these views) which advances the traveling hold-down blades 7 transversely during longitudinal advancement, for progressive carton erection. These blades cooperate with the ejection lugs 5, as described earlier. However, in the modified form, the erection lugs 9 and the conveyor 10 has been omitted and a rotating star wheel 212 cooperates with the ejection lugs 5 and blades 7 in erecting the carton.

The rotating star wheel 212 is mounted upon a cross shaft 213 mounted above the ejection conveyor 6. The star wheel 212 is rotated in time with the other components of the machine by a sprocket chain drive (not shown) which is in driving connection with the main shaft 21. In the present example, the star wheel is provided with a set of three radial arms 214 and is rotated in the direction indicated by the arrow. The arrangement is such that one of the arms engages the leading edge 219 of the carton after ejection from the magazine and advancement by the ejector lug 5, along the rails 144, as described earlier (FIGURES 10, 11 and 14) with one of the blades 7 shifted into the carton to confine it upon the rails 144 (FIGURE 21).

The speed of advancement of the carton, as indicated by the arrow 215 is greater than the speed of rotation of the star wheel, as indicated by the arrow 216. As a consequence, the leading upper edge 219 of the carton is restrained as it advances, causing progressive erection, as shown in FIGURES 22 and 23. As the carton approaches its fully erected position it passes beneath the hold-down bars 194 to be engaged between the fingers 12 of the transport conveyor 11 for advancement through the machine, as explained above.

In a second modification (FIGURES 24—26), utilizing the same principle of the coacting ejection lugs 5 and traveling blades 7, a modified star wheel 217 is mounted upon a cross shaft 218 which is also driven from main shaft 21. In this example, the star wheel is provided with a set of four arms 220, the trailing faces of which are curved inwardly as at 221 to assist in erecting the carton.

In this arrangement, the star wheel 220 is driven at a still slower rate of peripheral speed, such that the walls of the advancing cartons are sprung rearwardly as at 222 in the direction of advancement. This permits the cartons to pass under a set of restraining bars 223 which confines them in the rearwardly sprung condition as at 224. At this point, a lug 225 of an overhead conveyor 226 engages the trailing edge of the carton and advances it between the fingers 12 of the transport conveyor 11 for erection.

Carton tamping mechanism generally

As noted earlier, the loaded cartons advance from the carton loading and sealing machine 19 (FIGURE 1) with adhesive applied and with the flaps folded to closed position upon the adhesive coating. Before being discharged from the machine, the cartons pass through the discharge and tamping mechanism 13 (FIGURES 15—19). The tamping mechanism acts upon each carton to square up the side walls in the event distortion may have occurred during passage through the main section of loading and sealing machine 19. It will be understood that the adhesive has not yet set at this stage and that the flaps may be shifted slightly in their own planes, if necessary, to square the carton. After the tamping operation, the cartons pass into the drying conveyor 14 which applies heat

and pressure to the ends of the cartons to set the adhesive.

Upon reaching the end of the transport conveyor 11, the cartons are shifted through a one-quarter turn, such that they rest upon one side wall 229 as they advance through the tamping mechanism. By virtue of this arrangement, the tamping pressure is applied to the opposite side walls 229 of each carton before it passes into the drying conveyor.

As best shown in FIGURE 16, the downstream chain runs 206 of the transport conveyor 11 pass around a pair of idler sprockets 227 which are carried by a shaft 228 extending across the end portion of the second frame section 17. The erected cartons, after having been loaded, and with their end flaps glued and closed, are indicated at 230 in this view. At this stage, the adhesive is still in a moist condition to permit squaring of the carton at the tamping station, which is indicated generally at 231. It will be noted in this view (FIGURE 16) that the support rails 144—144, upon which the cartons rest during transport through the machine, include downwardly curved end portions 232—232 which are generally tangent to the periphery of the idler gears 227. The successive cartons cascade continuously down the curved portions 232 and rotate through the quarter turn, as noted above. The curved rails 232 lead downwardly to a support plate 233 which forms a part of the high speed conveyor 236 and tamping mechanism 231.

As the transport fingers 12 assume their radial positions in passing around the idler sprocket 227, the carton, as indicated at N, slides by gravity along the curved sections 232 while resting upon the leading pair of fingers 12 (FIGURE 16). The carton is thus rotated through one-quarter of a turn and deposited upon the support plate 233, resting upon one of its side walls 229. The pair of fingers 12, which lower the carton, then pass downwardly about the sprocket 227 and are returned to the upstream end of the machine. It will be noted that the width of the support plate 233 (FIGURE 17) is less than the transverse spacing of the fingers 12—12 to permit the fingers to straddle the plate without interference, as indicated at 235 (FIGURE 16).

High speed conveyor

Upon reaching the support plate 233, the carton is advanced toward the tamping station 231 by the high speed conveyor, indicated generally at 236, which forms a part of the discharge and tamping mechanism 13 (FIGURES 15—17). The high speed conveyor 236 advances the cartons 230 at a linear speed sufficiently greater than the speed of transport conveyor 11 to permit each carton to pause momentarily at the tamping station 231 for final squaring before being advanced to the drying conveyor, which is indicated generally at 237.

Described in detail (FIGURES 15—17), the high speed conveyor 236 comprises opposed pairs of upper and lower chain runs 238 mounted along opposite side edges of the support plate 233. The downstream end of the chain runs 238 pass about respective drive sprockets 240—240 which are keyed to the drive shafts 241—241. The drive shafts 241 are journaled in bearing brackets 242—242 (FIGURE 17) which are mounted upon the frame section 17. The drive shafts 241 are in driving connection with the main shaft 21 of the machine, as explained below.

The upstream ends of the chain runs 238 pass about idler sprockets 243 which are mounted upon idler shafts 244—244. The idler shafts 244 are mounted in bearing brackets 245—245 (FIGURE 16) rising from the support plate 233.

The chain runs 238—238 are driven in the direction indicated by the arrows (FIGURE 15) at a speed greater than the transport conveyor 11, as noted above, and each set of chain runs is provided with a set of vertical pusher bars 246 attached to the chains and adapted to engage the side wall of the carton, at opposite ends, after it is turned upon its side and delivered to the support plate 233.

Upon being thus deposited, the carton dwells momentarily upon the plate 233, then its opposite ends are engaged by the vertical pushers and advanced toward the tamping station 231, where the carton again dwells momentarily for the tamping operation.

The drive shafts 241—241 of the high speed conveyor are driven from main shaft 21 by a cross shaft 247 (FIGURE 16) having opposite ends journaled in the frame section 17. The cross shaft is in driving connection with the longitudinal main shaft 21 by a set of bevel gears (not shown). The bevel gear drive is similar to that previously described with reference to FIGURE 5. Cross shaft 247 is in driving connection with a second cross shaft 248 (FIGURE 17) by a sprocket drive 250. Cross shaft 248 has its opposite ends journaled in respective gear boxes 251—251 which are attached to a cross member 252 of frame section 17 (FIGURE 16). Cross shaft 248 includes respective bevel gears 253—253 (FIGURE 17) meshing with bevel gears 254—254 which are keyed to the vertical drive shafts 241, thereby to drive the chain runs 238 of the high speed conveyor at the required rate in unison with one another.

In order to align the cartons 230 with the tamping mechanism as they advance along the high speed conveyor 236, and to hold the end flaps in closed position, there is provided a pair of opposed vertical guide plates 255 (FIGURES 15 and 16) parallel with the inner runs of the high speed conveyor chains 238. The vertical pushers 246, which advance the carton, are mounted upon spacers 256 (FIGURE 17), adapting the pushers to pass along the opposed inner surfaces of the guide plates 255—255. The ends of the carton are thus slidably engaged by the guide plates 255 while the pushers 246 advance the cartons toward the tamping station 231.

As best shown in FIGURE 15, each guide plate 255 is adjustably mounted with reference to the support plate 233 upon an angle bracket 257 secured to a cross member 258. A pair of studs 260—260 project outwardly from each guide plate 255, the studs being locked in an adjusted position by the nuts 261.

Tamping mechanism

The tamping mechanism, previously indicated at 231, essentially comprises a presser foot 262 (FIGURE 17), mounted upon a vertical shaft 263 which is carried for vertical reciprocation in a slide bearing 264. The slide bearing forms part of a cantilever bracket having a vertical limb 265 rising from a cross member 266 of frame section 17. The slide bearings 264 is formed on the outer end of a horizontal arm 267 forming a part of the cantilever bracket and overhanging the high speed conveyor.

The presser foot 262 is reciprocated vertically to engaged and disengaged position with respect to the advancing cartons by a crank pin 268 (FIGURE 17) which projects outwardly from an adjustment disk 270. Adjustment disk 270 is secured in adjusted position to a gear 271 by screws 272 (FIGURE 17). The gear 271 is mounted upon a shaft 273 which is journaled in a bracket 274 attached to the frame section 17. Gear 271 (FIGURE 17) is rotated by a pinion 275 mounted upon a shaft 276 which is also journaled in the bracket 274. Shaft 276 is in driving connection with the main drive shaft 21 of the machine preferably by a sprocket drive (not shown) so as to reciprocate the presser foot 262 in time with the other components.

A vertical push rod 277 (FIGURE 17), for operating the presser foot, has its lower end journaled as at 278 to the crank pin 268. The push rod 277 is sectional and is adjustable in length by operation of the nut 280 to compensate for the size of the carton. The upper end of push rod 277 passes through a slide bearing 281 forming a part of a cross lever 282. The push rod 277 includes a compression spring 283 having its lower end seated upon a collar 284 and its upper end seated against the slide bearing 281.

This permits the push rod to overtravel slightly during the tamping stroke to impose the desired pressure upon the carton.

The cross lever 282 is pivotally mounted upon the upper end of the vertical limb 265 by means of the pivot pin 285 (FIGURE 17). The opposite end of lever 282 is connected to the vertical shaft 263 by a pin 286 projecting outwardly from shaft 263. Pin 286 is confined in a slot 287 formed in the lever to accommodate for the arcuate path described by the swinging end of the lever. Upon rotation of the crank pin 268 from the position of FIGURE 17 through a half turn, the linkage (push rod 277 and lever 282) shifts the presser foot downwardly into engagement with the top of the carton. Accordingly, the carton is compressed momentarily between the presser foot 262 and the support plate 233.

As noted earlier, the presser foot 262 is reciprocated in time with the advancement of the cartons by the transport conveyor 11, while the high speed conveyor 236 accelerates each carton to provide the dwell period which is necessary to permit the presser foot to act upon each carton. Thus, as shown in FIGURE 16, the carton indicated at 0 is advanced toward the tamping station 13 (presser foot 262) while the presser foot 262 is in engagement with the carton P which is arrested during the tamping operation. As the presser foot is elevated after the tamping operation (FIGURE 18), the carton 0 is advanced in a positive manner by the high speed conveyor, thus pushing the tamped carton P forwardly into engagement with the drying conveyor 14. The carton P is then carried through the drying conveyor which applies heat and pressure against opposite ends of the carton to set the adhesive, thereby to permanently seal the carton.

It will be understood at this point, that the pushers 246 provide positive engagement with the opposite ends of the carton until they begin to pass around the sprockets 240, at which point they disengage the carton and cause it to stop in tamping position beneath the presser foot 262. Thus, after pushing the carton P into the drying conveyor 14 (FIGURE 18) the carton Q is disengaged and pauses beneath the presser foot (FIGURE 19). Thereafter, the presser foot descends into tamping engagement (FIGURE 16) then retracts, leaving carton Q momentarily in a stationary position. The next successive carton R (FIGURE 19) then advances and pushes the carton Q into the drying conveyor 14. This cycle is repeated for each carton in a rapid positive manner.

The drying conveyor 14 does not form a part of the present invention and has not been disclosed in detail. In general (FIGURE 15) it comprises a pair of opposed belt runs 288—288 passing around rollers 290 which are journaled as at 291 adjacent the tamping station. As viewed in FIGURE 18, the support plate 233 continues along the drying conveyor to support the cartons. The drying conveyor advances somewhat faster than the transport conveyor and has sufficient length to thoroughly set the adhesive before the cartons are discharged from its downstream end.

Having described my invention I claim:

1. A carton handling mechanism for a carton loading and sealing machine, said carton handling mechanism adapted to eject flat collapsed cartons and to progressively erect the same during continuous advancement of the cartons, said carton handling mechanism comprising,
 - a carton magazine adapted to confine flat collapsed cartons in stack formation and having an open lower end,
 - a plurality of carton retaining elements mounted adjacent the open lower end of the magazine, said retaining elements normally residing in a carton retaining position and adapted to be shifted to a carton release position,
 - a reciprocating suction mechanism mounted adjacent the open end of the magazine and adapted to engage and withdraw the end carton of the stack from the

magazine when the retaining fingers shift to said carton release position,

continuously advancing ejection means mounted adjacent the open lower end of the carton magazine and adapted to engage the trailing edge of the carton which is withdrawn from the magazine by the suction mechanism and to shift the collapsed carton longitudinally from the magazine in a downstream direction,

an elongated carton support element extending longitudinally in the downstream direction from the open lower end of the magazine and adapted to support the carton upon ejection from the magazine,

a continuously advancing blade element movable longitudinally at the same rate and in the same direction as the collapsed carton which is ejected from the magazine,

said blade element having a component of transverse motion adapting the blade element to be inserted endwisely into the advancing collapsed carton, said blade element adapted to partially erect the carton and to hold the carton downwardly upon said carton support element during longitudinal advancement of the carton,

and continuously moving carton erection means adapted to engage the partially erected carton during longitudinal advancement thereof and to progressively erect the carton.

2. A carton handling mechanism for a carton loading and sealing machine, said carton handling mechanism adapted to eject flat collapsed cartons and to progressively erect the same during continuous advancement of the cartons, said carton handling mechanism comprising,

a carton magazine adapted to confine flat collapsed cartons in stack formation and having an open lower end,

continuously advancing ejection means mounted adjacent the open lower end of the carton magazine and adapted to engage the trailing edge of the end carton in said stack adjacent the open end of the magazine and to shift the collapsed carton longitudinally from the magazine in a downstream direction,

an elongated carton support element extending longitudinally in the downstream direction from the open end of the magazine and adapted to support the carton upon ejection from the magazine,

a continuously advancing blade element movable longitudinally at the same rate and in the same direction as the collapsed carton which is ejected from the magazine,

said blade element having a component of transverse motion adapting the blade element to be inserted endwisely into the advancing collapsed carton, said blade element adapted to partially erect the carton and to hold the carton downwardly upon said carton support element during longitudinal advancement of the carton,

continuously moving carton erection means adapted to engage the partially erected carton during longitudinal advancement thereof and to progressively erect the carton,

a transport conveyor having an upstream end disposed adjacent the downstream end of the carton erection means, said transport conveyor extending longitudinally through the carton loading and sealing machine and having a downstream end adapted to discharge the loaded and sealed cartons,

a second carton support element extending longitudinally from the downstream end of the transport conveyor,

and a reciprocating presser foot mounted adjacent the downstream end of the transport conveyor and adapted to reciprocate in time with the advancement

of the cartons and to engage each carton and to press the same against the second carton support element, thereby to square the carton.

3. A carton handling mechanism for a carton loading and sealing machine, said carton handling mechanism adapted to eject flat collapsed cartons and to progressively erect the same during continuous advancement of the cartons, said carton handling mechanism comprising,

a carton magazine adapted to confine flat collapsed cartons in stack formation and having an open end,

continuously advancing ejection means mounted adjacent the open end of the carton magazine and adapted to engage the end carton in said stack adjacent the open end of the magazine and to shift the collapsed carton longitudinally from the magazine in a downstream direction,

an elongated carton support element extending longitudinally in the downstream direction from the open end of the magazine and adapted to support the carton upon ejection from the magazine,

a continuously advancing blade element movable longitudinally at the same rate and in the same direction as the collapsed carton which is ejected from the magazine,

said blade element having a component of transverse motion adapting the blade element to be inserted endwisely into the collapsed carton, said blade element adapted to partially erect the carton and to hold the carton downwardly upon said carton support element during longitudinal advancement of the carton,

continuously moving carton erection means adapted to engage the partially erected carton during longitudinal advancement thereof and to progressively erect the carton,

a transport conveyor having an upstream end disposed adjacent the downstream end of the carton erection means, said transport conveyor extending through the carton loading and sealing machine and having a downstream end adapted to discharge the loaded and sealed cartons,

a second carton support element extending longitudinally from the downstream end of the transport conveyor,

a reciprocating presser foot mounted adjacent the downstream end of the second carton support element and adapted to reciprocate in time with the advancement of the cartons and to engage each carton and to press the same against the second carton support element, thereby to square the carton,

and a high speed conveyor extending along said second carton support element and adapted to advance the cartons from the downstream end of the transport conveyor at a lineal speed greater than the lineal speed of the transport conveyor, thereby to provide a dwell period adapting the said reciprocating presser foot to act upon the carton.

4. A carton handling mechanism for a carton loading and sealing machine, said carton handling mechanism adapted to eject flat collapsed cartons and to progressively erect the same during continuous advancement of the cartons, said carton handling mechanism comprising,

a carton magazine adapted to confine flat collapsed cartons in stack formation and having an open lower end,

a carton support element extending downstream from the open lower end of the magazine toward the carton loading and sealing machine,

a continuously advancing carton ejection conveyor mounted beneath the open lower end of said magazine, said ejection conveyor having longitudinally spaced ejection lugs adapted to engage and shift the cartons individually from the open lower end of the magazine and to shift the flat collapsed carton down-

stream along said longitudinal carton support element,

a continuously advancing blade conveyor mounted downstream from the magazine and extending along the ejection conveyor,

a series of normally retracted hold-down blades carried by the said run of the blade conveyor and adapted to advance longitudinally in endwise registry with the flat collapsed cartons after ejection thereof and during advancement along the carton support element,

means adapted to shift said hold-down blades transversely from the normally retracted position, whereby the blade is inserted transversely into an end of the flat collapsed carton by the coordinated longitudinal and transverse motion which is imparted to the blade, said blade adapted to partially erect and hold the collapsed carton downwardly upon the support element during advancement of the carton by the ejection lug,

a continuously advancing erection conveyor mounted parallel with the ejection conveyor in substantially the same plane,

the erection conveyor having an upstream portion overlapping the downstream portion of the ejection conveyor,

a plurality of erection lugs spaced longitudinally apart from one another and mounted upon the erection conveyor, said erection lugs normally residing in a retracted position beneath the plane of said carton support element.

and means for progressively elevating said erection lugs during advancement of the partially collapsed carton by the ejection lugs and with the advancing carton held in engagement with the support element by the hold-down blade,

said erection lugs adapted to engage the leading portion of the collapsed carton and thereby to erect the same progressively.

5. A carton handling mechanism as set forth in claim 1 in which the reciprocating suction mechanism includes suction mouthpieces arranged to engage the opposite end portions of the carton in the magazine and in which the carton retaining elements are adapted to be shifted to a carton release position as the reciprocating suction mechanism shifts outwardly from the open end of the magazine to permit withdrawal of the end carton of the stack for engagement by the continuously advancing ejection means, said retaining elements adapted to shift back into carton restraining position after the carton is withdrawn from the open end of the magazine, thereby to confine the next carton of the stack in the magazine.

6. A carton handling mechanism as set forth in claim 5 in which there is provided a rail element mounted adjacent the open end of the carton magazine in a position to engage the mid-portion of the carton which is withdrawn from the magazine by said suction mouthpieces, said suction mouthpieces, upon outward reciprocation in engagement with the end portions of the carton, being adapted to bring the mid-portion of the carton into engagement with the rail element and to bow the end portions of the carton outwardly, said continuously advancing ejection means being located in a plane to engage the outwardly bowed end portions of the carton, thereby to shift the bowed carton in a downstream direction from the rail elements and into engagement with the elongated carton support element.

7. A carton handling mechanism as set forth in claim 4 in which the continuously advancing carton ejection conveyor comprises two parallel chain runs, and respective pairs of transversely aligned ejection lugs mounted on said parallel chain runs adapted to engage the end portions of the lowermost carton of the stack for shifting the carton longitudinally from the open end of the magazine to said carton support element.

8. A carton handling mechanism as set forth in claim 4 in which there is provided a reciprocating suction mechanism having suction mouthpiece mounted thereon and adapted to engage the end portions of the lowermost carton at the open lower end of the magazine, and a rail element mounted adjacent the open lower end of the magazine adapted to engage and support the mid-portion of the carton as it is withdrawn from the magazine by the suction mouthpieces, thereby to bow the carton upon downward reciprocation of the suction mouthpieces, said ejection lugs being mounted in a plane and having notches adapted to engage the trailing edge of the downwardly bowed opposite end portions of the carton for shifting the same in a downstream direction from the magazine toward the carton support element, said suction mouthpieces being adapted to release the bowed endwise portions of the magazine upon engagement thereof by the ejection lugs.

9. A carton handling mechanism as set forth in claim 7 in which the reciprocating suction mechanism comprises respective levers having their inner end portions pivotally connected to a bearing located between the parallel chain runs of the ejection conveyor, the levers having generally vertical arm portions straddling said pair of ejection chain runs, the upper ends of said arms each including suction mouthpieces engageable with the opposite end portions of the carton, said vertical arm portions and suction mouthpieces adapted to swing in an arc downwardly to bring the end portions of the carton into a plane for engagement by the advancing ejection lugs.

10. A carton handling mechanism as set forth in claim 7 in which the reciprocating suction mechanism comprises respective levers having their inner end portions pivotally connected to a bearing located between the pair of parallel chain runs of the ejection conveyor, the levers having generally vertical arm portions straddling said pair of ejection chain runs, the upper ends of said arms each including suction mouthpieces engageable with the opposite end portions of the carton, and a rail element mounted adjacent the open lower end of the magazine, said vertical arm portions and suction mouthpieces adapted to swing in an arc downwardly to bring the mid-portion of the carton into engagement with the stationary rail element, thereby to bow the flat collapsed carton and to bring the bowed portions of the carton into a plane for engagement by the advancing ejection lugs.

11. A carton handling mechanism as set forth in claim 10 in which there is provided respective pairs of pivotally mounted carton retainer fingers straddling said pair of ejection chain runs and including projections adapted to engage the lowermost carton of the stack, said retaining fingers normally residing in a carton engaging position and being shifted outwardly to a carton release position as the lowermost carton is bowed downwardly by said suction mouthpieces, said carton retainer fingers adapted to be shifted back to the carton retaining position with the said projections engaging the next lowermost carton of the stack after the end portions of the lowermost carton have been bowed downwardly by said suction mouthpieces.

12. A carton handling mechanism as set forth in claim 7 in which the continuously advancing erection conveyor comprises a single chain run, said single chain run having an upstream end interposed between the downstream end portions of the two ejection chain runs, the relative longitudinal spacing between the ejection lugs and erection lugs being such that the trailing edge of the collapsed blank is engaged by the pair of transversely aligned ejection lugs while the leading portion of the partially erected blank is engaged at its central portion by one of the erection lugs for progressive erection during advancement of the carton along the overlapping portions of the ejection chain runs and erection chain runs.

13. A carton handling mechanism as set forth in claim

12 in which the ejection lugs are pivotally connected to the ejection chain runs and in which the ejection chain runs each include elongated support elements, said ejection lugs each including a lower surface slidably engaging the elongated support elements, said support elements adapted to hold said ejection lugs in an elevated carton ejecting position during advancement of the lugs beneath the open end of the magazine to provide advancement of the carton, said support elements adapting the ejection lugs to pivot downwardly to a carton release position at the downstream portion of the ejection conveyor runs, and a transport conveyor having transport fingers projecting upwardly therefrom, said transport fingers adapted to engage the erected carton when the same is released by said ejection lugs.

14. A carton handling mechanism as set forth in claim 4 in which the erection lugs are pivotally connected to the continuously advancing erection conveyor and in which there is provided a longitudinal cam plate, said erection lugs each having an element movably engaging said longitudinal cam plate, said cam plate adapted to pivot the erection lugs from said retracted position to an elevated position during longitudinal advancement of the erection lugs, thereby to progressively erect the advancing carton.

15. A carton handling mechanism as set forth in claim 13 in which the erection lugs are pivotally connected to the continuously advancing erection conveyor and in which there is provided a longitudinal cam plate, said erection lugs each having an element movably engaging said longitudinal cam plate, said cam plate adapted to pivot the erection lugs from said retracted position to an elevated position during longitudinal advancement of the erection lugs, thereby to progressively erect the advancing carton, said cam plate adapted to lower said elevated ejection lug at about the same time said cam plate lowers the erection lug, adapting the erected carton to be transferred to a position between the transport fingers.

16. A carton handling mechanism as set forth in claim 4 in which the continuously advancing blade conveyor is mounted alongside the ejection conveyor and parallel therewith and having a pair of parallel chain runs disposed in substantially the same plane as the carton support element, said chain runs advancing continuously in the same direction and at the same linear speed as the ejection conveyor, means slidably connecting the hold-down blades to said parallel chain runs, adapting the hold-down blades to be shifted transversely with respect to said chain runs during longitudinal advancement of the blades.

17. A carton handling mechanism as set forth in claim 16 in which there is provided a stationary cam track and in which each hold-down blade includes a cam follower in tracking engagement with the stationary cam track, said cam track being configured to shift said blades from a retracted position to an advanced position during longitudinal motion of said plates from the upstream portion of the ejection conveyor, thereby to insert the blade endwise into the advancing carton, said cam track being configured to retract said blade after the carton is erected between the ejection lug and erection lug.

18. A carton handling mechanism as set forth in claim 1 in which the continuously moving carton erection means comprises a rotary element which is in the form of a star wheel having a plurality of radial arms, said star wheel rotating in time with the advancement of the partially erected carton advancing along the ejection means, with the hold-down blade inserted into and traveling with the partially erected carton, each radial arm adapted to engage the leading portion of one of said advancing cartons and to shift the same progressively to an erected position during advancement of the carton.

19. A carton handling mechanism as set forth in claim 2 in which the downstream end of the transport conveyor

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includes an idler sprocket, said transport conveyor passing in an arc about said idler sprocket and adapted to deliver the erected cartons to said second carton support element, and a control plate extending generally tangent to said idler sprocket and curving downwardly toward the second carton support element, said carton control element adapted to deliver said cartons in cascade fashion and to rotate said cartons through a quarter turn for deposit upon said second carton support element.

20. A tamping mechanism for a carton loading and sealing machine, said carton loading and sealing machine having a transport conveyor extending there-through and having vertical transport fingers adapted to confine and transport erected cartons through the loading and sealing machine, said transport conveyor having an idler sprocket at the downstream end thereof adapting said fingers to move radially about said idler sprocket to discharge the cartons therefrom, said tamping mechanism comprising:

a carton support element extending longitudinally from the downstream end of the transport conveyor and disposed in a plane below the transport conveyor;

a curved carton control plate disposed generally in a tangent relative to the idler sprocket of the transport conveyor and curving downwardly from the transport conveyor to the said carton support surface;

said curved carton control plate adapted to engage the carton at the downstream end of the transport conveyor, to rotate the carton through a quarter turn, and to deposit the carton on the carton support element;

a reciprocating presser foot mounted above the carton support element and reciprocating in time with the advancement of the cartons and engaging each carton and pressing the same against the carton support element, thereby to square the carton;

and a high speed conveyor extending along said carton support element and adapted to advance the cartons from the downstream end of the transport conveyor at a lineal speed greater than the lineal speed of the transport conveyor, thereby to provide a dwell period adapting the said reciprocating presser foot to act upon the carton.

21. A carton handling mechanism as set forth in claim 20 in which the transport conveyor comprises two parallel chain runs and in which the transport fingers are arranged in transversely aligned pairs upon said chain runs, thereby to engage opposite end portions of the erected cartons, said carton control plate being disposed between the parallel chain runs, whereby the carton is supported upon the

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transport fingers at opposite ends of the carton during movement about said curved control plate, the transversely aligned transport fingers adapted to support the carton in a horizontal position during advancement of the carton about said control plate as the carton is rotated through said quarter turn for deposit upon the carton support element.

22. A carton handling mechanism as set forth in claim 20 in which the high speed conveyor comprises respective pairs of upper and lower chain runs mounted along opposite sides of the carton support surface, a plurality of vertical pushers mounted on said upper and lower chain runs, said vertical pushers being transversely aligned with one another along the opposite sides of the carton support element and adapted to engage the opposite ends of the carton after said carton is rotated through said quarter turn and deposited upon said carton support element, thereby to confine the carton and to maintain the carton in a position at right angles to the support element during advancement to said presser foot.

23. A carton handling mechanism as set forth in claim 22 in which there is provided respective pairs of idler rollers at the downstream end of the upper and lower chain runs with said runs tracked about said idler sprockets, said transversely aligned vertical pushers to pass in an arcuate path about said idler sprockets, thereby to disengage the carton, adapting the carton to rest in stationary position upon said support element, said presser foot being located in a position adjacent said idler sprockets to act upon the stationary carton, said presser foot adapted to reciprocate in time with the advancement of the vertical pushers, thereby to press the carton against said support element and to release the pressed carton before the next successive carton is advanced to the presser foot.

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