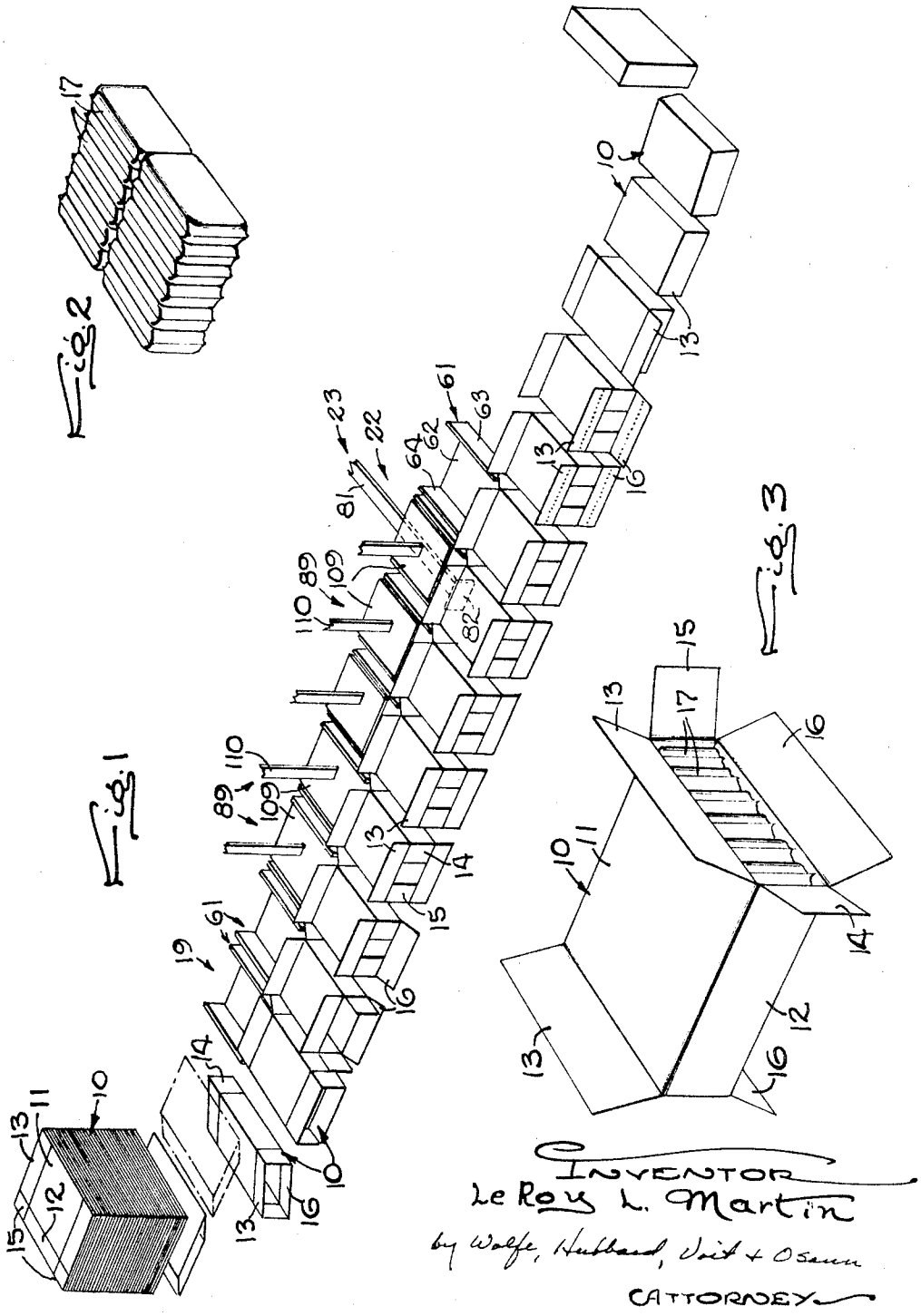
Aug. 30, 1966 LE ROY L. MARTIN 3,269,091

CARTONING MACHINE

Filed Sept. 19, 1962

8 Sheets-Sheet 1



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CARTONING MACHINE

Filed Sept. 19, 1962

8 Sheets-Sheet 2

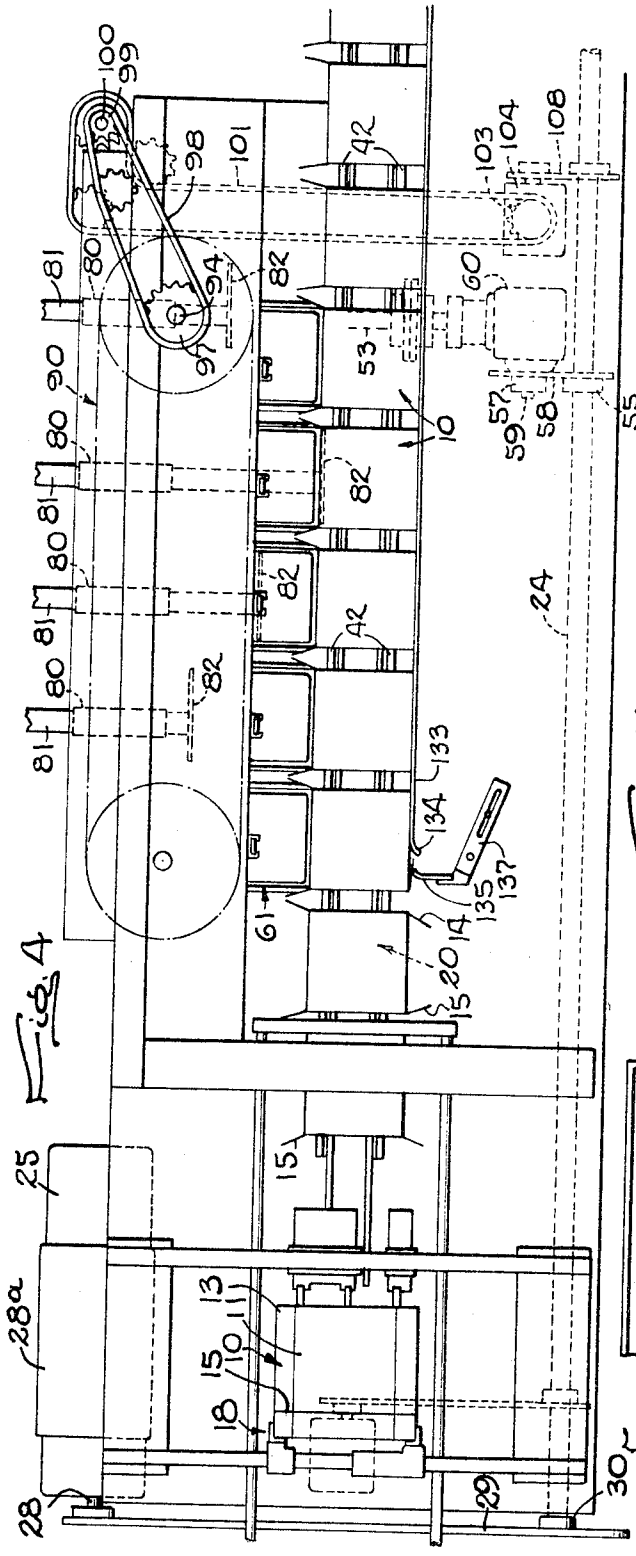

Fig. 4

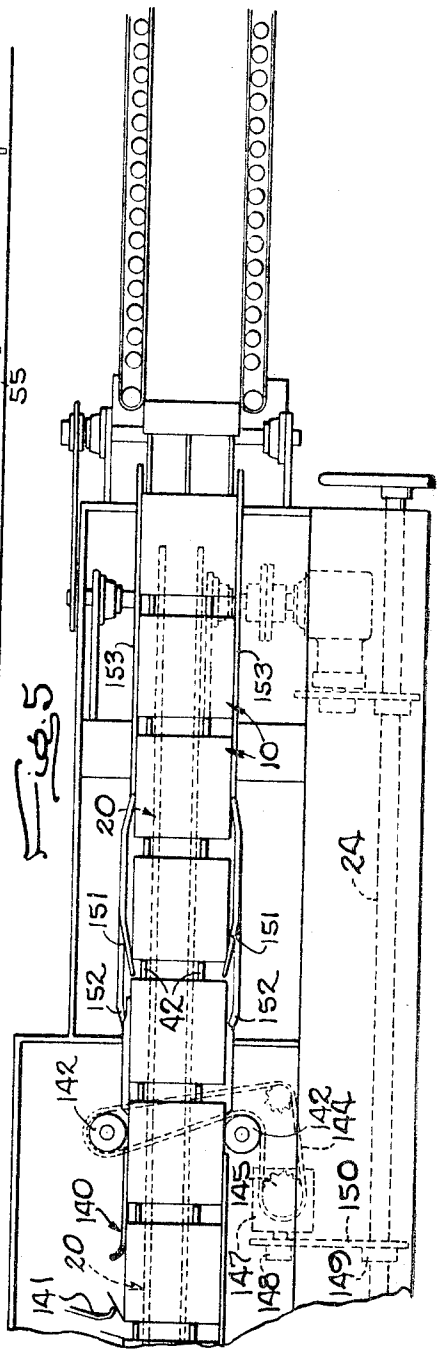

Fig. 5

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CARTONING MACHINE

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8 Sheets-Sheet 3

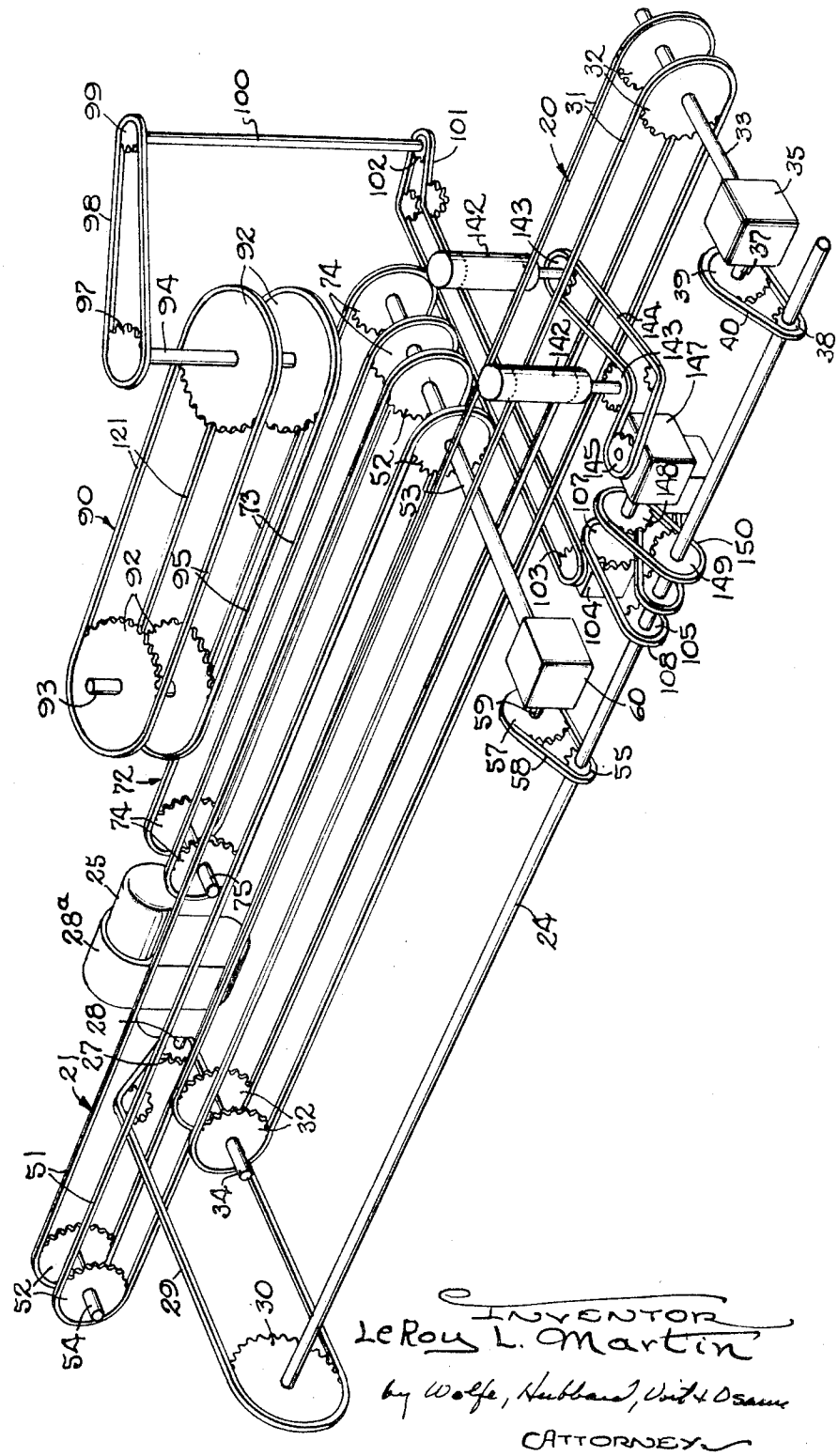

Fig. 6

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CARTONING MACHINE

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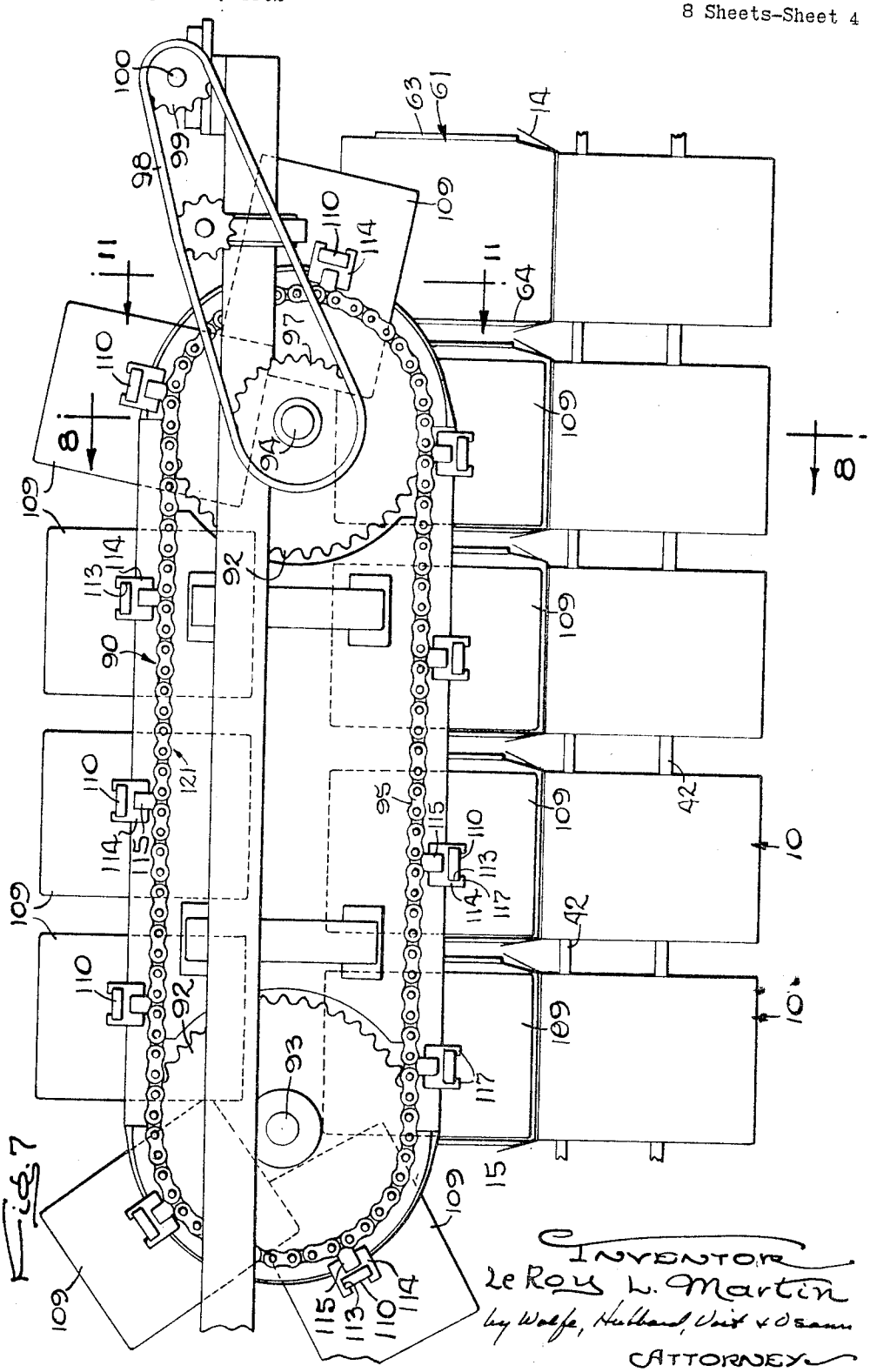

Fig. 7

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8 Sheets-Sheet 5

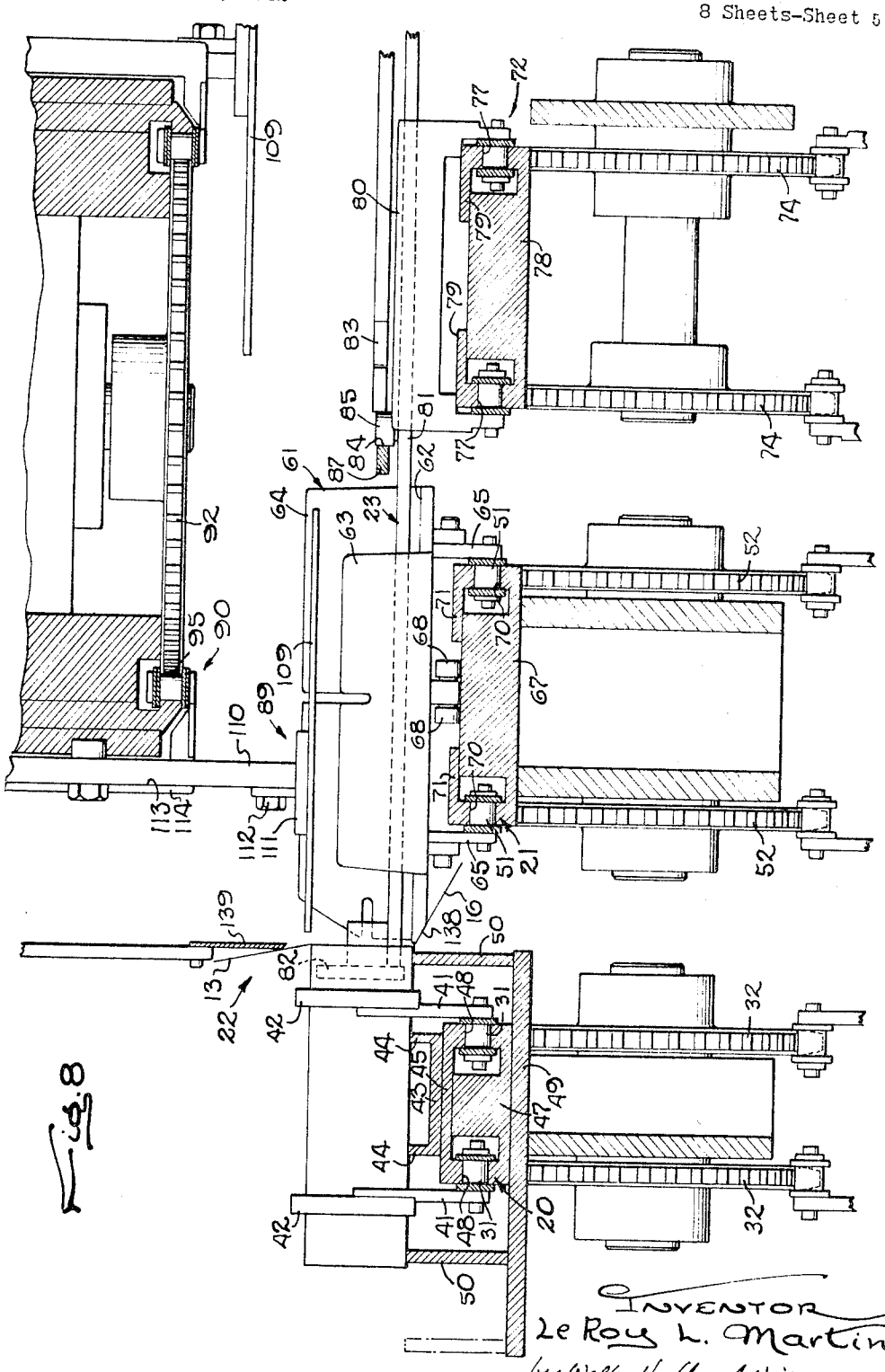

Fig. 8

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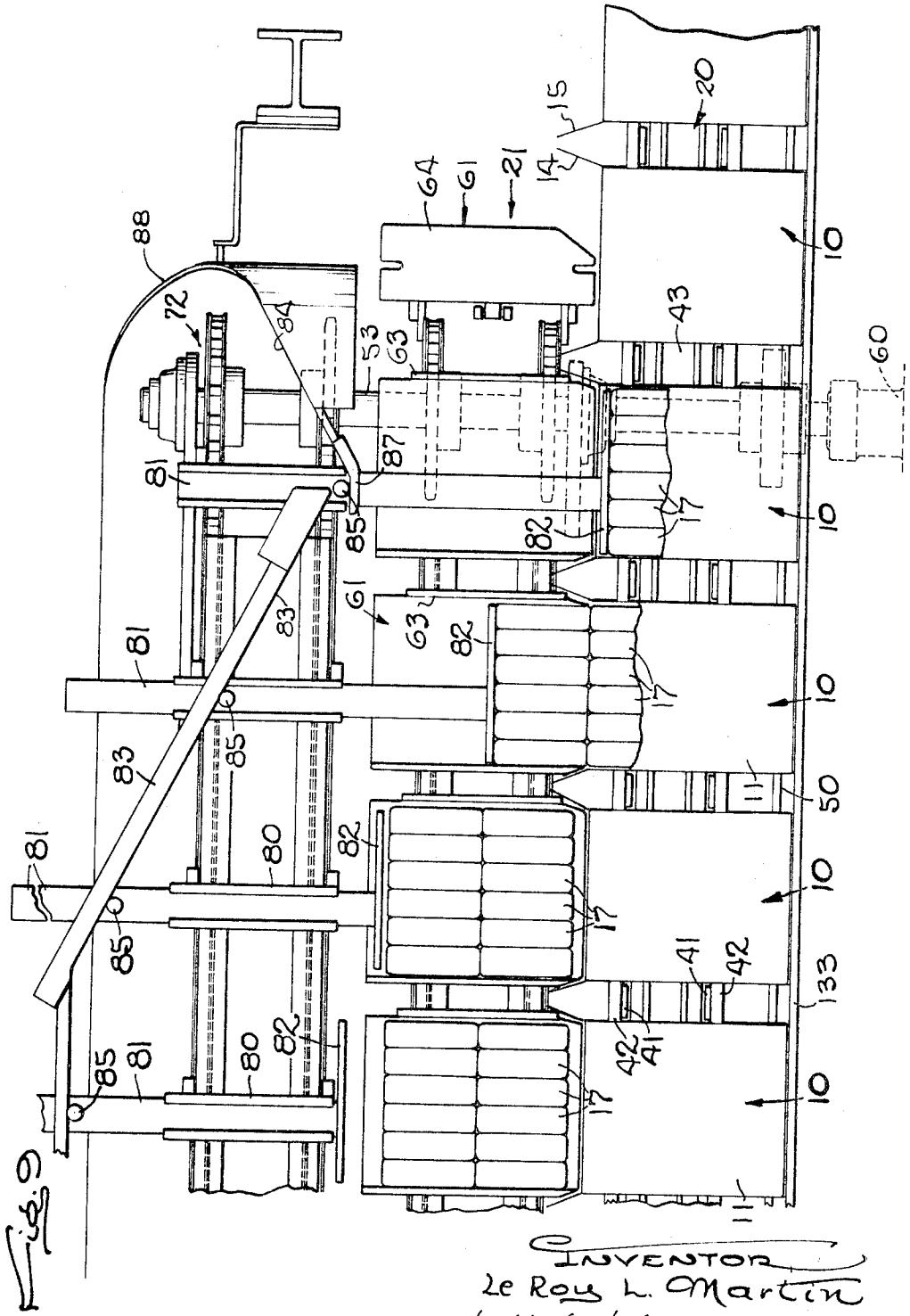

Fig. 9

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Fig. 10

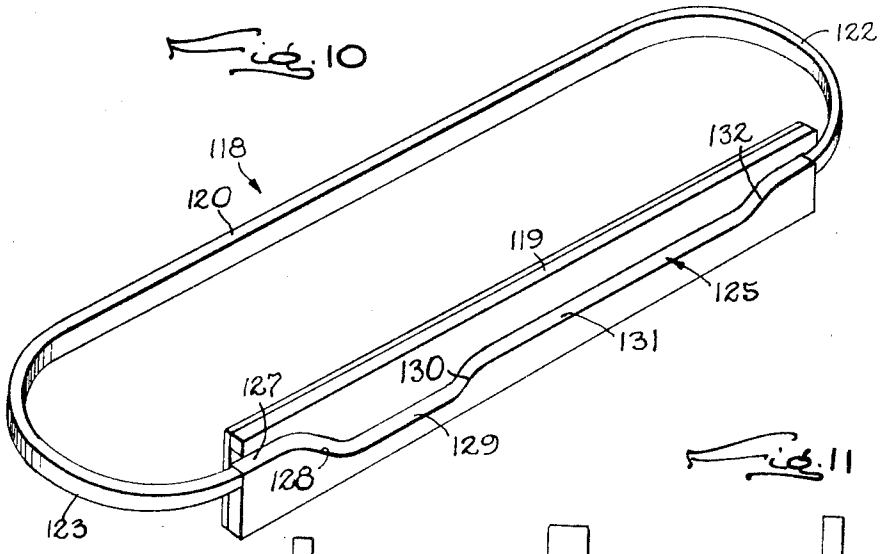


Fig. 11

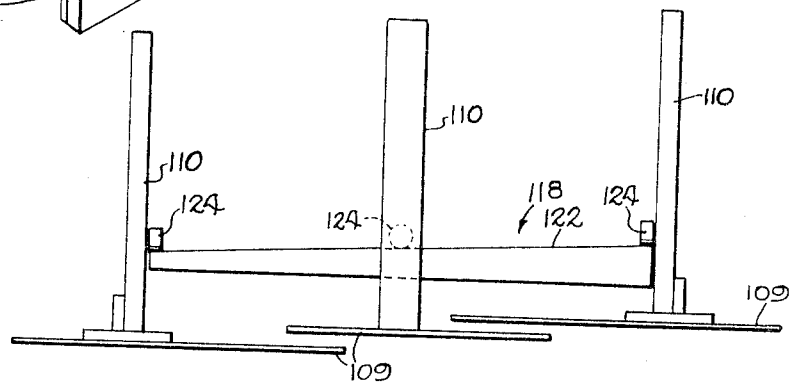
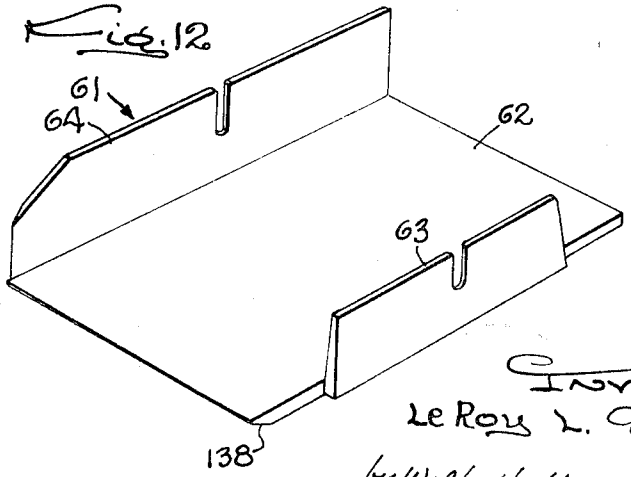


Fig. 12



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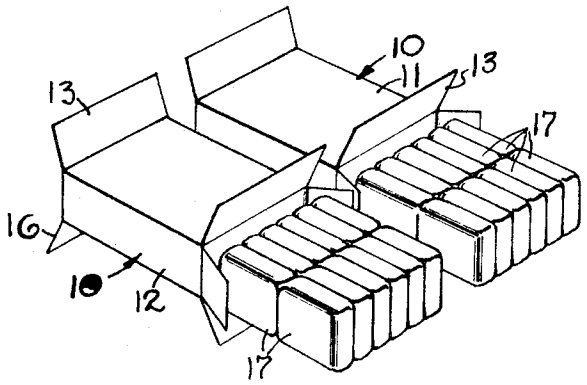

Fig. 13

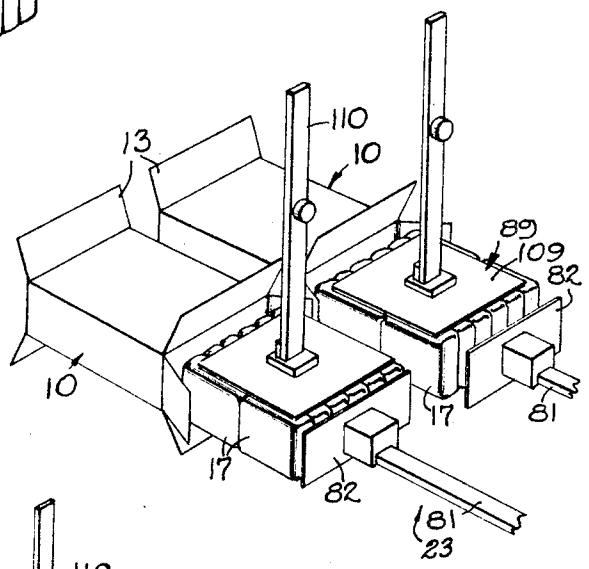

Fig. 14

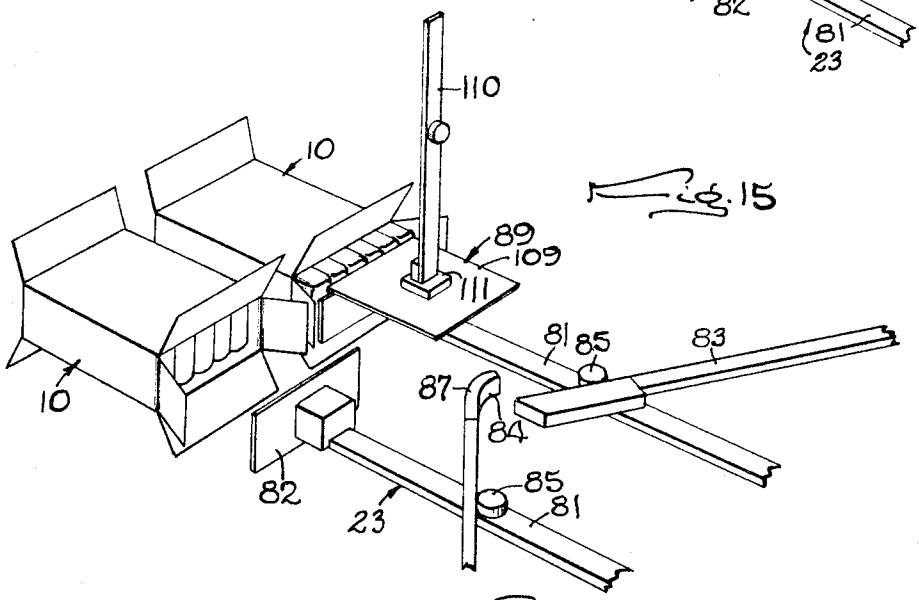

Fig. 15

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United States Patent Office 3,269,091 Patented August 30, 1966

3,269,091

CARTONING MACHINE

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Filed Sept. 19, 1962, Ser. No. 224,810
3 Claims. (Cl. 53—252)

This invention relates to a continuous motion machine for loading packaged products into cartons and closing the latter. More particularly, the invention relates to a cartoning machine in which articles such as bags containing a compressible powdered product or the like are advanced in buckets on a continuously moving carrier alongside a continuously moving carton carrier and are transferred laterally at a loading station into the alined carton on the carton carrier.

The primary object of the present invention is to provide novel means for insuring that the bags will slide freely into the cartons with a close fit.

A more specific object is to provide a plurality of pressers movable together by an endless carrier along a path having a portion disposed above the bag carrier, the pressers also being movable individually relative to the carrier toward and away from the bags between raised positions and lowered positions in which the pressers are above the bottoms of the buckets a distance less than the height of the cartons thereby to compress the bags to a height less than that of the cartons.

Another object is to release the bags for free sliding into the cartons from beneath the pressers while insuring that the tendency of the product to fluff or expand does not result in an oversize condition of the bags.

Still another object is to control the elevation of the pressers in a novel manner such that relatively large presser plates may be utilized and will pass around a relatively short radius on the carrier without interfering with or abutting against one another.

A further object is to facilitate the adjustment of the presser controlling means to accommodate different sizes of cartons and bags.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a schematic perspective view illustrating the steps performed by a machine embodying the novel features of the present invention.

FIG. 2 is a perspective view of a stack of bags to be cartoned.

FIG. 3 is a somewhat enlarged perspective view of an open carton with a stack of bags therein.

FIG. 4 is an enlarged fragmentary plan view of the forward portion of the novel machine.

FIG. 5 is a fragmentary plan view of the rear portion of the machine shown in FIG. 4.

FIG. 6 is a schematic perspective view of the various driving mechanisms in the machine.

FIG. 7 is an enlarged fragmentary plan view similar to a portion of FIG. 4.

FIG. 8 is an enlarged fragmentary sectional view taken along the line 8—8 of FIG. 7.

FIG. 9 is a view similar to FIG. 8 showing the carton loading mechanism, with parts broken away and shown in section.

FIG. 10 is an enlarged perspective view of the presser controlling means.

FIG. 11 is a fragmentary end view of the pressers and the controlling means, this view being taken substantially along the line 11—11 of FIG. 7.

FIG. 12 is an enlarged perspective view of a bag carrying bucket.

FIG. 13 is a perspective view of cartons and stacks of bags in proper relation for the loading operation.

FIG. 14 is a view similar to FIG. 13 and including the pressers and loaders.

FIG. 15 is a view similar to FIG. 14 including the loading mechanism with the parts in different positions.

As shown in the drawings for purposes of illustration, the invention is incorporated in a continuous motion machine for filling and closing cartons **10** each of which comprises two side panels **11** and two edge panels **12** and is closed at each end by folding in four flaps **13** to **16** projecting outwardly from the ends of the respective carton panels. In this instance, the cartons are filled with a plurality of stacked bags **17** of loose material such as powdered detergent, the bags being stacked in two end-to-end rows of six side-by-side bags each as shown in FIGS. 2 and 13. These stacks are sized to fit snugly in the cartons.

On the machine, the cartons **10** are stored in collapsed condition in a magazine **18** (see FIG. 4) and are withdrawn one by one from the magazine and transferred to a receiving station **19** (FIG. 1) at one end of a carrier **20** while being opened in a well-known manner during this transfer. The carrier **20** supports the cartons in evenly spaced relation and advances them edgewise along a path through successive operating stations where the cartons are filled, glued, closed and finally discharged from the machine. A second carrier **21** disposed on one side of and closely adjacent the carton carrier supports and advances the stacks of bags to the loading station **22** (FIG. 1) where loaders **23** shift the stacks into alined cartons on the carton carrier.

Preferably, the various mechanisms for transferring, filling, and closing the cartons are mounted on an elongated horizontal frame and are operated in timed relation with each other by a single horizontal camshaft **24** (FIG. 6) journaled on the frame and generally paralleling the path followed by the cartons. The camshaft is driven continuously by an electric motor **25** (FIGS. 4 and 6) mounted adjacent the forward end of the frame with a sprocket wheel **27** fast on the shaft **28** of a speed reducer **28a** driving an endless chain **29** trained around a second sprocket wheel **30** on the camshaft.

In this instance, the carton carrier **20** is in the form of two endless chains **31** (FIGS. 6 and 8) disposed in parallel vertical palnes and running around sprocket wheels **32** arranged in pairs and mounted on two horizontally spaced shafts **33** and **34** journaled on the frame as shown most clearly in FIG. 6. The shaft **33** is driven by the camshaft through gearing in a gear box **35** in which one end of the shaft is journaled, the connection between the gearing and the camshaft comprising a shaft **37** journaled in the gear box, sprocket wheels **38** and **39** on the camshaft and the gear shaft respectively, and an endless chain **40** trained around the two sprocket wheels.

To hold the cartons on the carrier **20**, pairs of arms **41** (FIG. 8) are evenly spaced along the two chains **31** and carry blocks **42** which, when on the upper runs of the chains, project upwardly on opposite sides of a rail **43** supported between the chains with two flanges **44** on the rail projecting upwardly to engage the undersides of cartons. The rail is supported on two interfitting bars **45** and **47** disposed respectively above and below the chains and defining laterally opening slots **48** (see FIG. 8) in which the chains ride. Thus, the chains are guided and braced between the bars **45** and **47**. The rail **43** and the bars are fast on a horizontal frame plate **49** between the upper and lower runs of the chains, and side rails **50** upstanding from the plate **49** on opposite sides of the chains engage the cartons adjacent the ends of the latter.

The adjacent edges of successive pairs of blocks 42 are spaced apart a distance substantially the same as the carton widths and the blocks of each pair are laterally spaced apart a distance less than the length of the cartons. Thus, each carton is held in a pocket formed by the leading and trailing edges of two pairs of blocks and is slid by the blocks along the tops of the flanges 44 and the side rails 50 while being held in properly spaced relation with the rest of the cartons on the carrier in passing through the various operating stations of the machine.

Similarly, the bag carrier 21 is formed by two endless chains 51 (FIGS. 6 and 8) in parallel vertical planes on one side of the carton carrier, these chains being wound around spaced sprocket wheels 52 on horizontal shafts 53 and 54 journaled on the frame. The shaft 53 is driven by the camshaft 24 through sprocket wheels 55 and 57, an endless chain 58, a gear shaft 59, and gearing in a box 60 in which one end of the carrier shaft 53 is journaled, the shaft being geared to the gear shaft 59. The upper horizontal runs of the chains 51 define the path followed by the bags and are level with and preferably parallel to the upper runs of the carton carrier chains 31. The two carriers overlap along most of their lengths as shown most clearly in FIG. 6.

The stacks of bags 17 are carried on the chains 51 in buckets 61 (see FIG. 12) formed by rectangular bottom plates 62 having upright flanges 63 and 64 at their leading and trailing edges. The spacing of the buckets along the bag carrier is the same as the spacing of the pockets along the carton carrier, the buckets being fastened to the chains by means of lugs 65 (FIG. 8) and riding along the top of a contoured bar 67. Rollers 68 are journaled on blocks fast on the undersides of the buckets to roll on the top of the bar and support the chains 51 against downward deflection. Also, the chains ride in guide slots 70 defined between the bar 67 and the plates 71 fast on the upper side of the bar and projecting over the chains.

With this arrangement of the carriers 20 and 21, the cartons 10 and bags 17 are positioned on the respective carriers and advanced thereby along parallel side-by-side paths at the same speed with one bucket alined with the adjacent open end of each carton. At the loading station 22, a loader 23 enters the bucket through the end thereof remote from the carton and pushes the stack of bags laterally out of the bucket through the opposite end and into the carton. Preferably, the bucket bottoms are supported level with or slightly above the bottom panels of the cartons.

Herein, the loaders 23 comprise a plurality of rams carried on still another carrier 72 (FIG. 6) to move with the bag and carton carriers as the latter approach and pass the loading station. This carrier also is formed by two endless chains 73 disposed in vertical planes on the side of the bag carrier remote from the carton carrier and running around horizontally spaced pairs of sprockets 74, one pair being mounted on a shaft 75 journaled on the forward portion of the machine frame and the other pair being mounted on the shaft 53 with the rear set of bag carrier sprockets 52 as shown in FIG. 7 so that the loader carrier is driven directly with the bag carrier. The loader chains 73 ride in guide slots 77 defined between a contoured rail 78 (FIG. 8) and plates 79 projecting over the chains, and carry horizontally disposed, laterally opening sleeves 80 (FIGS. 8 and 9) which are above the chains when on the upper runs thereof. The spacing of these sleeves is such that one sleeve is alined with each bucket and also with the adjacent open end of the carton alined with the bucket. The interiors of the sleeves preferably are rectangular in cross-section.

Slidable endwise back and forth in each sleeve transversely of the three carriers in an elongated bar 81 which also is of rectangular cross-section. A flat plate 82 is fast on the end of the bar adjacent the bag carrier in an upright position level with the stack in the bucket and thus is shifted by the bar sidewise into and out of the alined bucket to engage the stack and push it into the alined carton.

To produce this back and forth motion of the loader rams at the appropriate point along the path of the rams, elongated horizontal cam arms 83 and 84 are mounted above and inclined across the path of the rams to engage follower rollers 85 journaled on and projecting upwardly from the bars 81. The cam 83 is inclined forwardly and toward the bag carrier to press the rollers and hence the rams progressively toward and through the buckets as the latter approach and reach the loading station. The return cam 84 is inclined forwardly and away from the bag carrier and includes a hooked finger 87 (FIGS. 9 and 15) at its leading end which picks up each roller after the associated bucket is unloaded and then retracts the roller and the ram. As shown in FIG. 9, the return cam curves downwardly at 88 around the end of the loader carrier to maintain engagemnet with the rollers as the loaders pass along the lower run of the carrier and back to the leading end thereof.

The present invention contemplates the provision of novel means for compressing the stacks of bags 17 in the buckets 61 to a predetermined height slightly less than the height of the carton interiors thereby insuring that the stacks will enter the cartons freely but without excessive clearance in the cartons. For this purpose, a plurality of pressers 89 are mounted on the machine to travel above the buckets and move toward and away from the buckets between raised positions and lowered positions in which the pressers are above the level of the bucket bottoms 62 a distance slightly less than the height of the cartons. Thus, the pressers compress the height of the stacks to that distance.

In the present instance, the pressers comprise a series of rams spaced apart along a carrier 90 and moved thereby along a predetermined path above and paralleling the path of the buckets 61, the spacing of the rams being the same as the spacing of the buckets. The rams also are movable individually back and forth transversely of the path of the bucket carrier 21 toward and away from the associated buckets, and means is provided to lower the rams into the aforementioned lowered positions as they approach the loading station 22.

The presser carrier 90 is formed by two endless chains disposed in horizontal planes and running around two pairs of sprockets 92 mounted on spaced upright shafts 93 and 94 positioned so that one run 95 of each chain is disposed over the buckets 61 approaching and passing through the loading station 22, these runs being shown on the lower left of the carrier in FIG. 6.

To drive the presser carrier, a sprocket 97 mounted on the upper end of the shaft 94 is rotated by an endless chain 98 trained around a sprocket 99 on another upright shaft 100 (FIGS. 6 and 7) journaled on the frame. This shaft is rotated by an endles chain 101 (FIG. 6) wound around a sprocket 102 on the lower end of the shaft and also around a sprocket 103 driven through gearing in a box 104. The gearing is driven by the camshaft 24 through sprockets 105 and 107 and a chain 108. Through the selection of suitable gear and sprocket ratios, the presser carrier is driven at the same speed as the bag and carton carriers.

The presser rams 89 are formed by horizontally disposed rectangular plate 109 approximately equal in area to the area of the bucket bottoms 62, the plates being fast on the lower ends of elongated upright bars 110 by means of T-shaped brackets 111 (FIGS. 8, 14 and 15) welded to the plates and bolted at 112 to the bars. The upper end portions of the latter project upwardly through and are slidably received in grooves 113 (see FIG. 7) in guides 114 fast on lugs 115 rigid with the chains, the bars being held in the grooves by lips 117 projecting partially across the open side of each groove from opposite edges thereof. Preferably, both the bars 110 and the grooves 113 are rectangular in cross-section.

As the carrier 90 moves above the bag carrier 21, the

up and down motions of the rams relative to the carriers are produced by an endless cam 118 (FIG. 10) comprising a straight, grooved plate 119 disposed above and paralleling the runs 95 of the presser chains, a bar 120 disposed above the other runs 121 of the chains, and curved bars 122 and 123 connecting the ends of the plate 119 and the bar 120 around the sprockets 92. Mounted intermediate the ends of each ram bar 110 is a roller 124 which projects over and rides on the upper edges of the bars 122, 120 and 123 as the rams pass around the sprockets and along the runs 121. Thus, the contour of these upper edges controls the elevation of the rams when the latter are inactive.

When the rams are on the runs 95 of the chains, the rollers 124 ride in the groove 125 in the plate 119 and are lowered and raised by contact with the upper and lower walls of this groove. At the leading end of the plate, the rollers are raised to hold the plates 109 well above the buckets 61 and clear of the bags 17 therein. Herein, this condition occurs at 127 approximately four bucket widths in advance of the loading station 22 as shown in FIG. 1. Then, as the rams move toward the loading station, the groove dips downwardly at 128 (FIG. 10) to lower the rams toward the buckets, the upper wall of the groove forcing each ram downwardly to compress the bags in the bucket below the ram. When the groove levels off at 129, the rams are spaced above the bucket bottoms a distance slightly less than the height of the cartons. Thus, the stacks in the buckets are compressed sufficiently to fit into the cartons.

In order to release the compressed stacks for free sliding from the buckets, the rams are elevated slightly before the buckets are unloaded. This is accomplished by a rise 130 in the groove 125. To insure that any tendency of the product to expand or fluff will not result in an oversize condition, however, this rise preferably is less than the original compression stroke and levels off at 131 with the plates 109 still somewhat below the tops of the cartons. For example, the plates may be pressed initially to one-eighth inch below the carton tops and then raised to one-thirty-second below the tops to relieve the pressure on the stacks. At 132, the groove rises substantially to raise the rollers to the level of the bar 122.

As shown in FIG. 11, the curved cam bars 122 and 123 prevent interference between the adjacent edges of the presser plates 109 while permitting them to turn about a relatively short radius in passing around the sprockets 92. For this purpose, the top surface of the bar 122 rises gradually from the trailing end of the groove 125 to the adjacent end of the straight bar 120 and thereby permits the plates to overlap each other at vertically staggered levels without abutting against each other. Similarly, the top edge of the other curved bar 123 descends gradually toward the leading end of the groove 125 so that the levels of the plates also are staggered as the plates pass around the sprocket at the leading end of the presser carrier. With the curved bars formed in this manner, the presser carrier may be made relatively compact to conserve space despite the relatively large size and close spacing of the plates.

It will be seen that the grooved plate 119 alone controls the pressing and pressure-relieving portions of the ram strokes. Thus, simply by removing the section of the cam formed by the plate and substituting another plate having a groove following a different path between the curved bars, the pressers are adjusted for different sizes of stacks and cartons. This is accomplished quickly and easily without changing the rest of the cam structure. The plate is removably secured to the frame by any suitable means such as bolts (not shown).

The width of the stacks is controlled by the spacing of the flanges 63 and 64 of the buckets 61 which confine the stacks in the buckets. When stacks and cartons of widths narrower than the spacing of the flanges are to be used, spacer blocks (not shown) may be fastened to one or both of the flanges. Thus, the flanges, the bucket bottoms 62, and the presser plates 109 cooperate to form a restricting enclosure which insures that the stacks are smaller in size than the carton interior to slide freely into the cartons without being substantially smaller than the cartons.

After the cartons 10 are filled, they may be closed and glued in various ways well known to those skilled in the art. In this instance, the edge flaps 14 and 15 at one end of each carton are closed prior to the filling of the cartons as illustrated schematically in FIG. 1. The leading edge flap 14 is cammed rearwardly and over the end of the carton by a stationary plow 133 (FIGS. 4 and 5) with an outwardly flared end 134 located a short distance past the forward end of the carton carrier, while the trailing edge flap 15 is folded forwardly by a revolving finger 135 mounted on the frame alongside the carton carrier slightly in advance of the end of the plow 133. In a well-known manner, the finger is mounted on a sliding and swinging arm 137 and is operated by the camshaft 24 to sweep the trailing edge flap forwardly and against the end of the carton as the latter passes the end of the plow.

Thus, both edge flaps at this end are held in their folded positions by the plow as the carton continues through the machine. The top and bottom flaps 13 and 16 at this end are folded respectively upwardly and downwardly preparatory to the gluing operation to be described.

At the other ends of the cartons 10, the edge flaps 14 and 15 are spread apart by the opposite edges of the bottoms 62 of the buckets 61 and the lower flaps 16 are held down in out-of-the-way positions by the adjacent edge portions of the bucket bottoms, these edges being beveled at 138 (FIG. 12) to hold the flaps down at a suitable angle. The upper flaps 13 are folded upwardly and held out of the way by a plow 139 as shown in FIG. 8.

When a stack of bags 17 has been loaded into a carton 10, the edge flaps on the end adjacent the bag carrier 21 are folded in by a stationary plow 140 and a revolving finger 141 (FIG. 5) in a manner similar to the closing of the edge flaps at the opposite end. Then, with the top and bottom flaps at the ends disposed in parallel vertical planes, the cartons are carried past and pressed between two glue drums 142 (FIGS. 5 and 6) each having two parallel, axially spaced rows of perforations alined with the respective top and bottom flaps. The drums 142 are driven through sprockets 143 on the drum shafts, an endless chain 144 wound in opposite directions around the sprockets, and a sprocket 145 driving the chain. The last-mentioned sprocket is driven through a gear box 147 by sprockets 148 and 149 and a chain 150, the sprocket 149 being mounted on and turning with the camshaft 24.

Glue supplied to the drum perforations thus is applied to the flaps 13 and 16 in the manner shown in FIG. 1. Then, the flaps are folded over the ends of the cartons and against the already closed edge flaps by inclined plows 151 and 152 (FIG. 5) above and below the cartons. The trailing portions 153 of these plows press the flaps tightly together and insure tight sealing of the carton ends before the cartons are discharged from the machine.

I claim as my invention:

1. In a cartoning machine, the combination of, a carton carrier movable along a first path through a loading station, means on said carrier for supporting a series of cartons of predetermined height in evenly spaced relation and advancing the cartons edgewise along said path through said station with one end of each carton opening to one side of said path, an article carrier closely adjacent one side and movable along a second path to said station, means on said article carrier for supporting a series of compressible articles to be cartoned and holding the articles in alinement with the open carton ends at said station, a plurality of presser elements including flat and horizontally disposed plates, an endless presser carrier

disposed generally in a horizontal plane and having a run disposed above said article carrier and movable along a third path following said second path, means mounting said elements on said presser carrier with one element disposed above each article and movable relative to the presser carrier toward and away from said article carrier, a wheel at each end of said run drivingly supporting said presser carrier, mechanism for driving said carriers continuously and in unison to deliver successive cartons, articles, and elements simultaneously to said station, means for moving said elements individually toward and away from said article carrier along said run to shift said plates back and forth between raised positions and lowered positions in which the plates are spaced above the article carrier a distance less than said predetermined height, and shifting each plate into said lowered position as the article below it approaches said station thereby to compress the article to a height less than said predetermined height, a loader for transferring each article laterally off said article carrier and into the alined carton at said station, and means for vertically moving said elements gradually as the latter pass around said wheels thereby staggering the levels of successive plates and permitting said plates to overlap without interference in turning about a relatively short radius.

2. In a machine for loading compressible articles into cartons of predetermined height, the combination of, a frame, an article carrier on said frame movable along a predetermined path, means on said carrier for supporting a series of articles in evenly spaced relation and advancing the articles along said path, a plurality of presser elements, an endless presser carrier having one run disposed above and following a portion of said path, a wheel at each end of said run drivingly supporting said presser carrier, means mounting said elements on said presser carrier for back and forth movement toward and away from said article carrier with one element disposed above each article on the article carrier, mechanism for driving said carriers continuously and in unison, an endless cam supported on said frame and following the path of said presser carrier, said cam including a section following said one run, a follower on each element riding on said cam, said section defining a predetermined path to raise and lower said followers and thereby shift each element at a predetermined point along said one run into a lowered position in which the element is spaced from the article carrier a distance less than said predetermined height thereby to compress the article below the element, and

then elevate said elements toward raised positions, and means releasably securing said section to said frame whereby the cam is adjusted for different carton and article heights by removing said section and substituting therefor a section defining a different path.

3. In a cartoning machine, the combination of, a carton carrier movable along a first path through a loading station, means on said carrier for supporting a series of cartons of predetermined height in evenly spaced relation and advancing the cartons edgewise along said path through said station with one end of each carton opening to one side of said path, an article carrier closely adjacent said one side and movable along a second path to said station, means on said article carrier for supporting a series of compressible articles to be cartoned and holding the articles in alinement with the open carton ends at said station, a plurality of presser elements, a presser carrier disposed above said article carrier and movable along a third path following said second path, means mounting said elements on said presser carrier with one element disposed above each article and movable relative to the presser carrier toward and away from said article carrier, mechanism for driving said carriers continuously and in unison to deliver successive cartons, articles, and elements simultaneously to said station, means for moving each of said elements individually from a raised into a lowered position as the element approaches said station, back to an intermediate position as the element passes through said station, and finally back to said raised position, said elements being spaced above the article carrier in said lowered positions a distance less than said predetermined height to compress the articles thereon, and being spaced above the article carrier in said intermediate positions a distance also less than said predetermined height thereby relieving the pressure on the articles while limiting expansion of the articles, and a loader for transferring each article laterally into the alined carton at said station.

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