

March 6, 1973

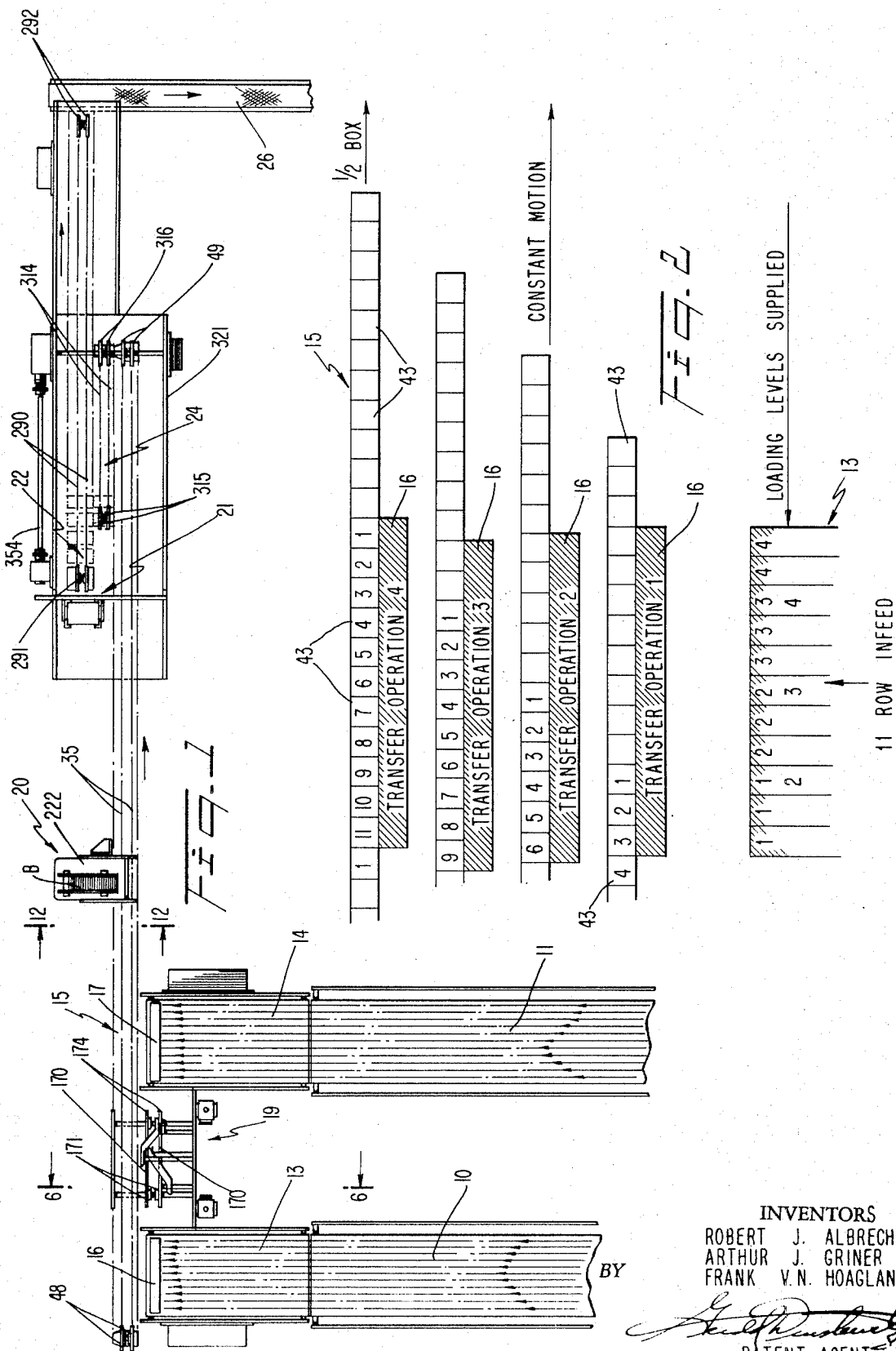
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 1



INVENTORS
 ROBERT J. ALBRECHT
 ARTHUR J. GRINER
 FRANK V.N. HOAGLAND
 BY *Frank V.N. Hoagland*
 PATENT AGENT

March 6, 1973

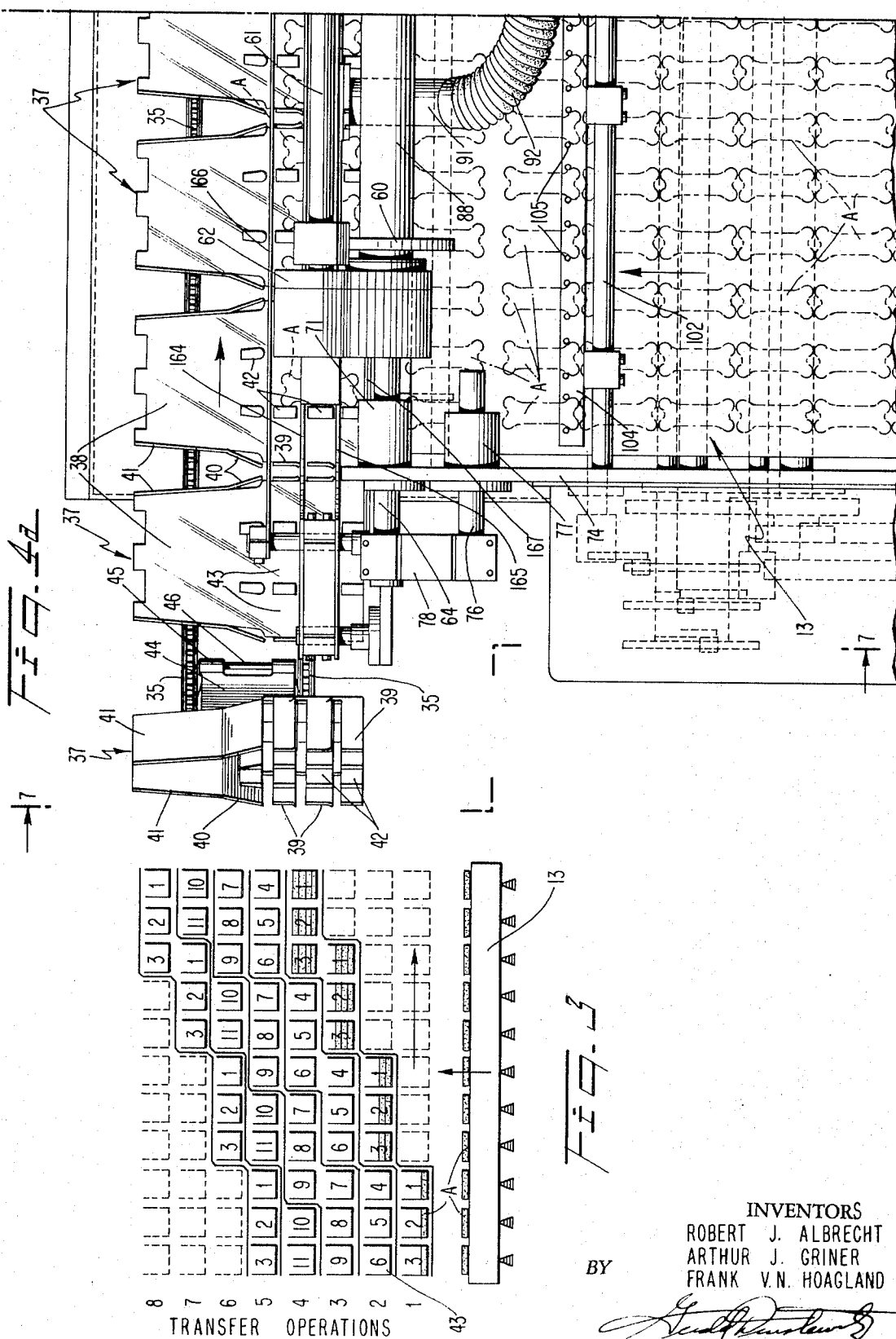
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 2



March 6, 1973

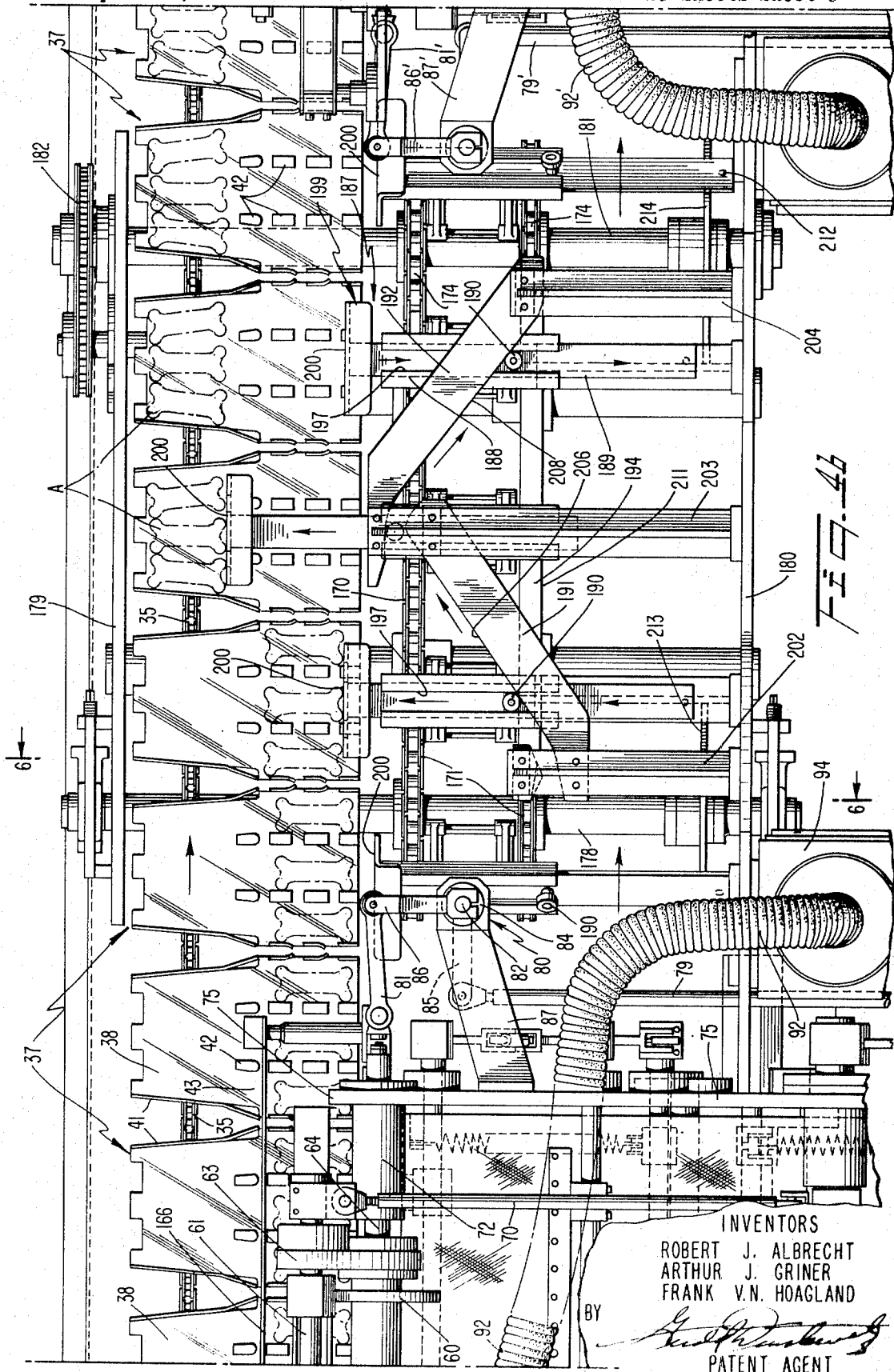
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 3



March 6, 1973

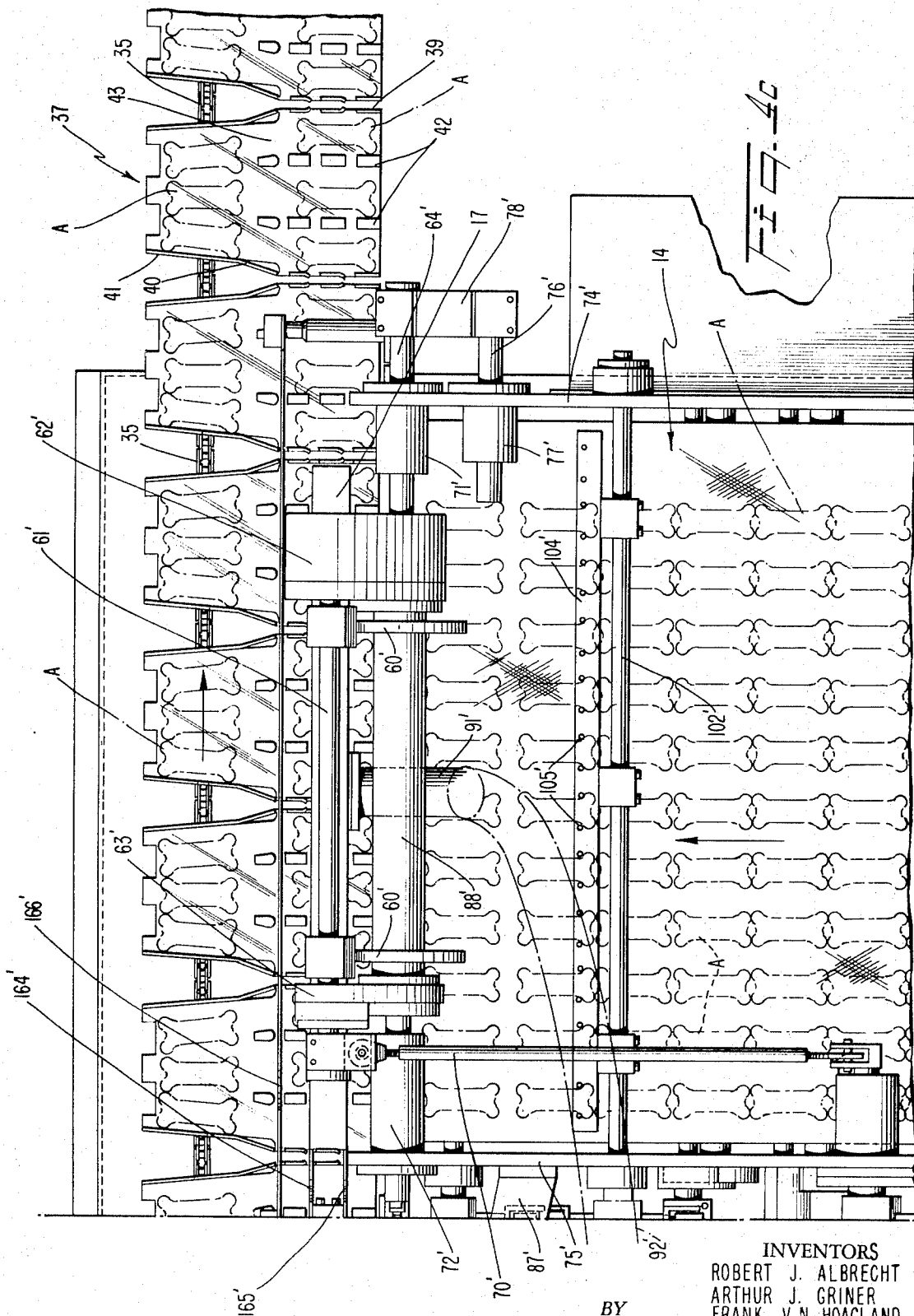
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 4



INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

BY

PATENT AGENT

March 6, 1973

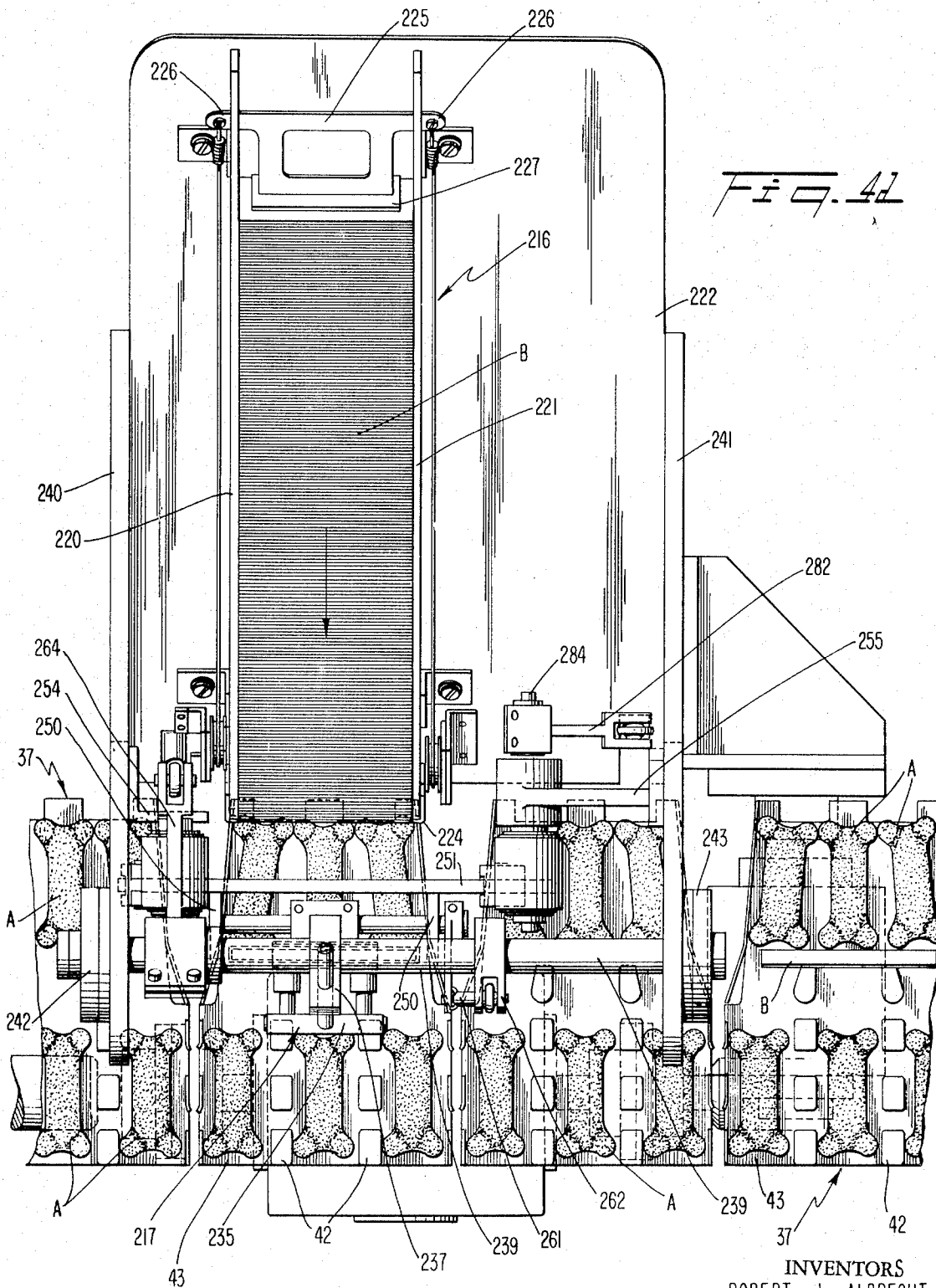
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 5



BY

INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

Frank V. N. Hoagland
PATENT AGENT

March 6, 1973

R. J. ALBRECHT ET AL

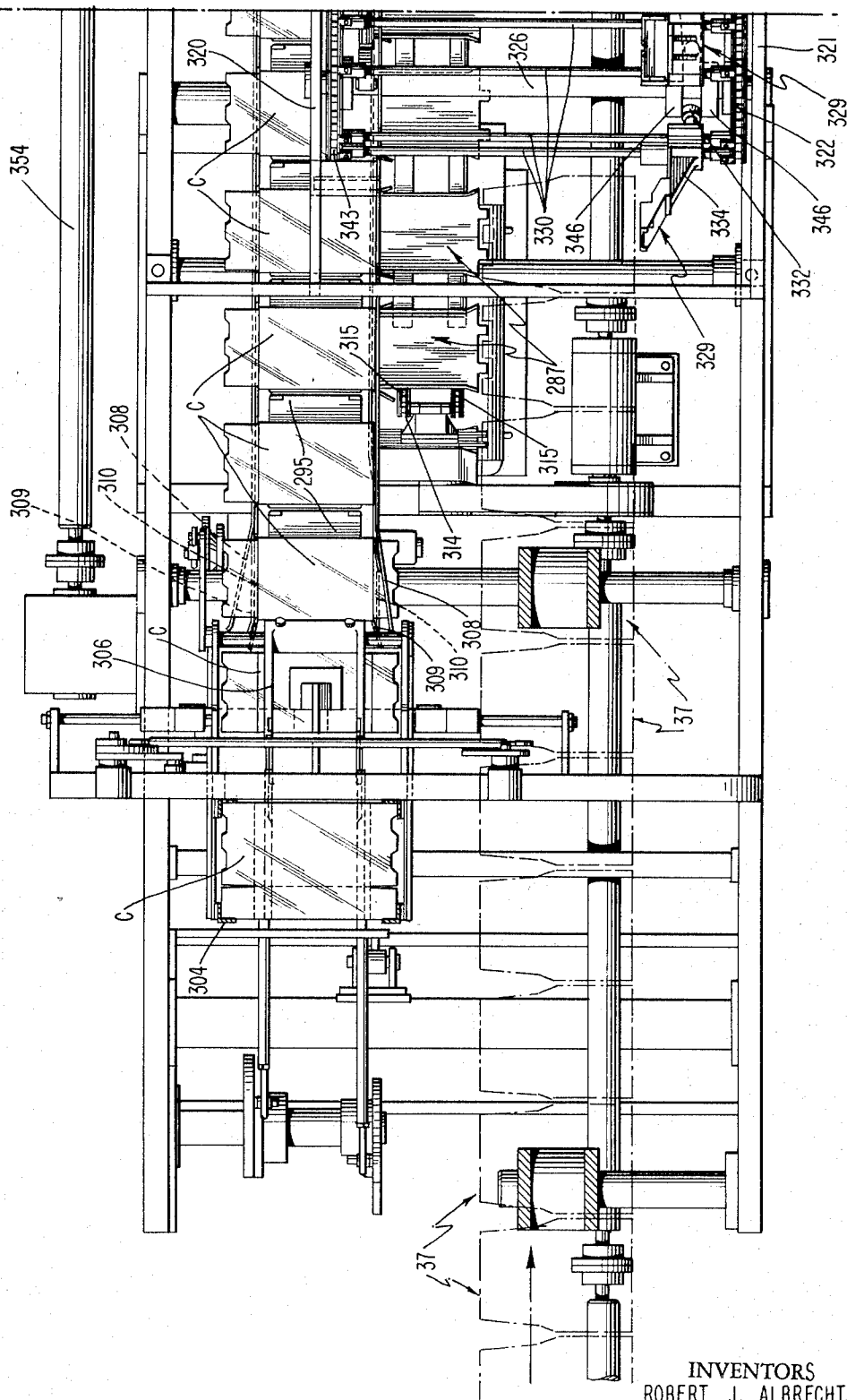
3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 6

Fig. 4B



BY

INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V.N. HOAGLAND

Frank V.N. Hoagland
PATENT AGENT

March 6, 1973

R. J. ALBRECHT ET AL

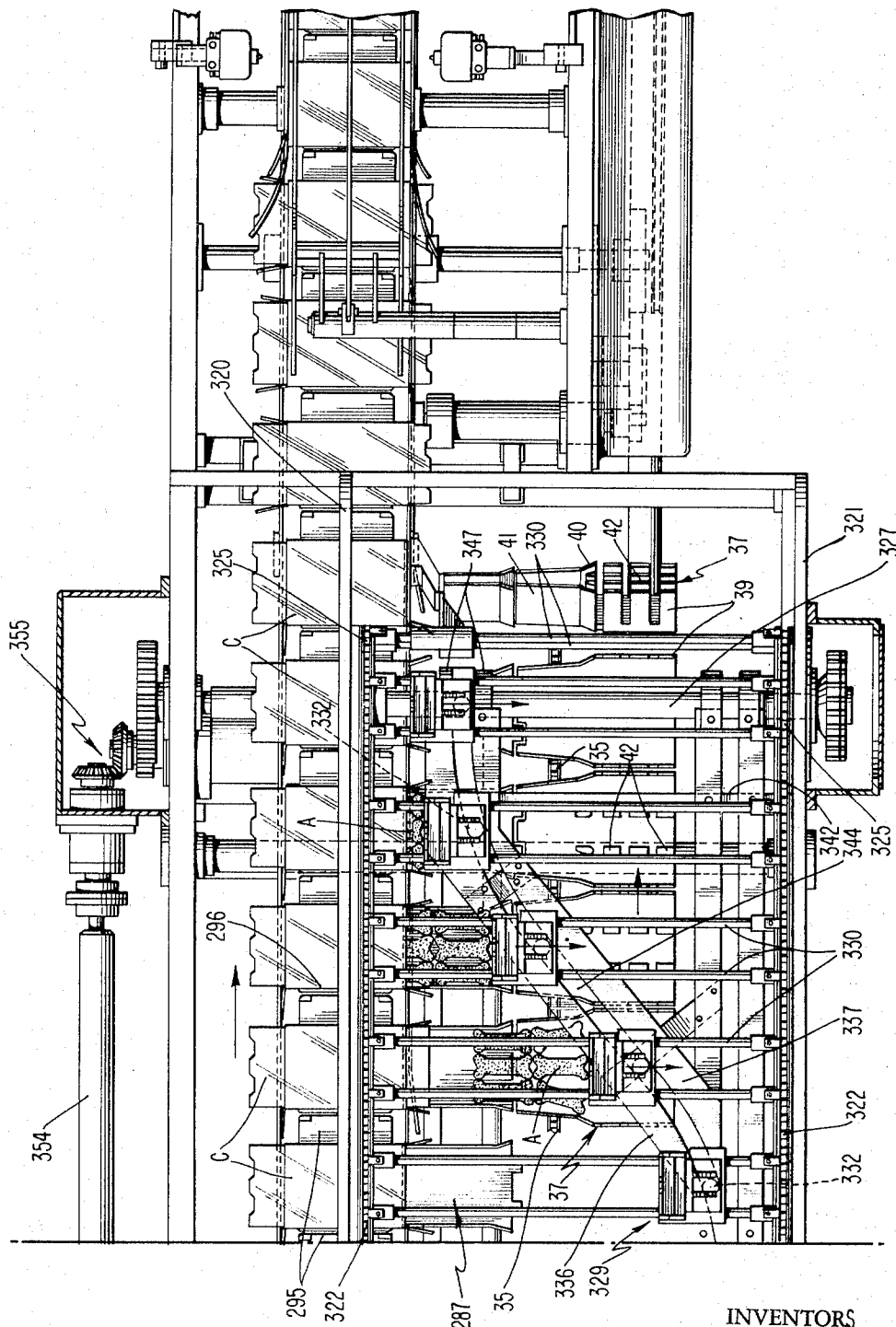
3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 7

Fig. 4F



BY

INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V.N. HOAGLAND

Frank V.N. Hoagland
PATENT AGENT

March 6, 1973

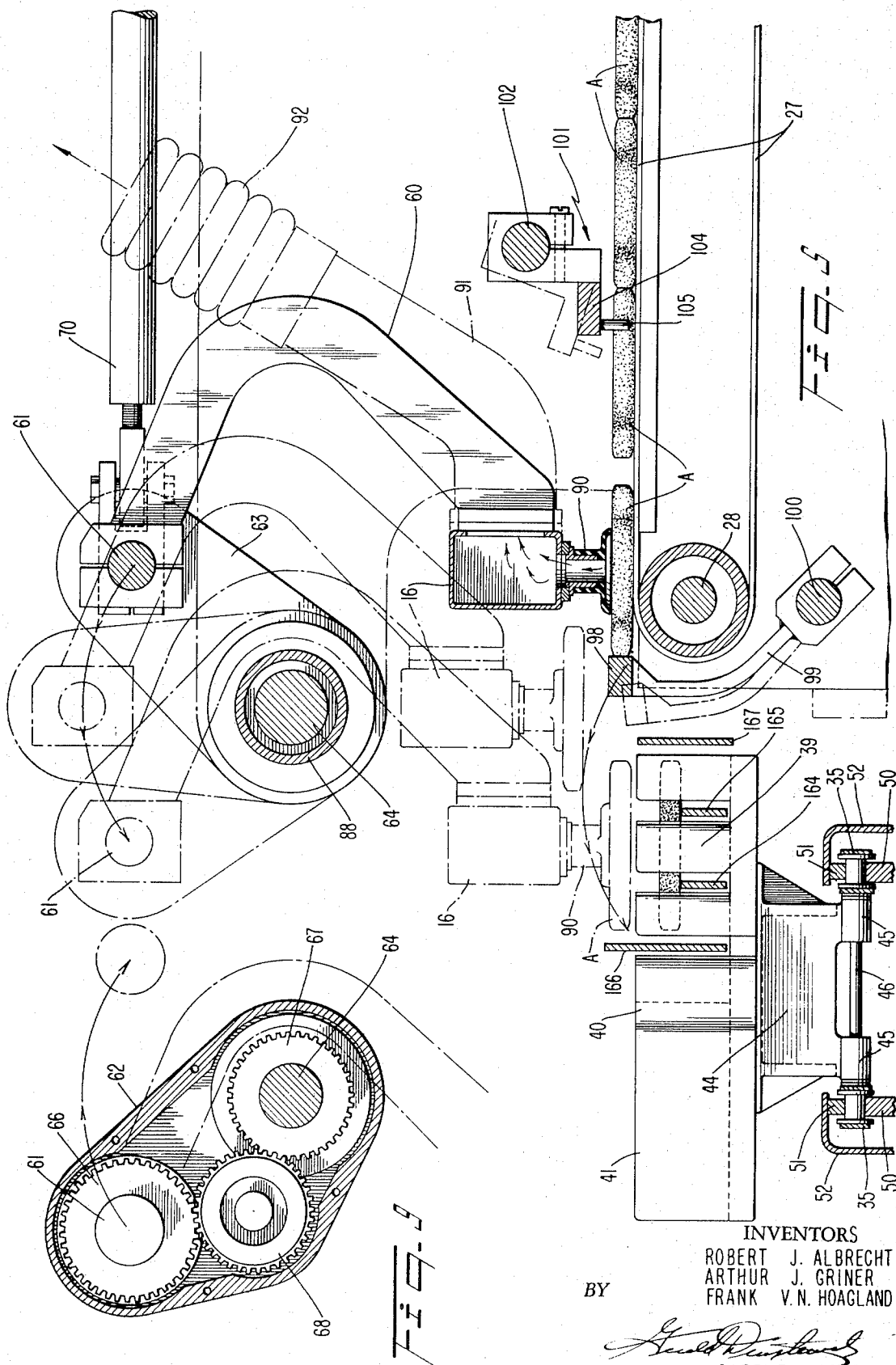
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 8



INVENTORS

ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

BY

Harold R. Hoagland
PATENT AGENT

March 6, 1973

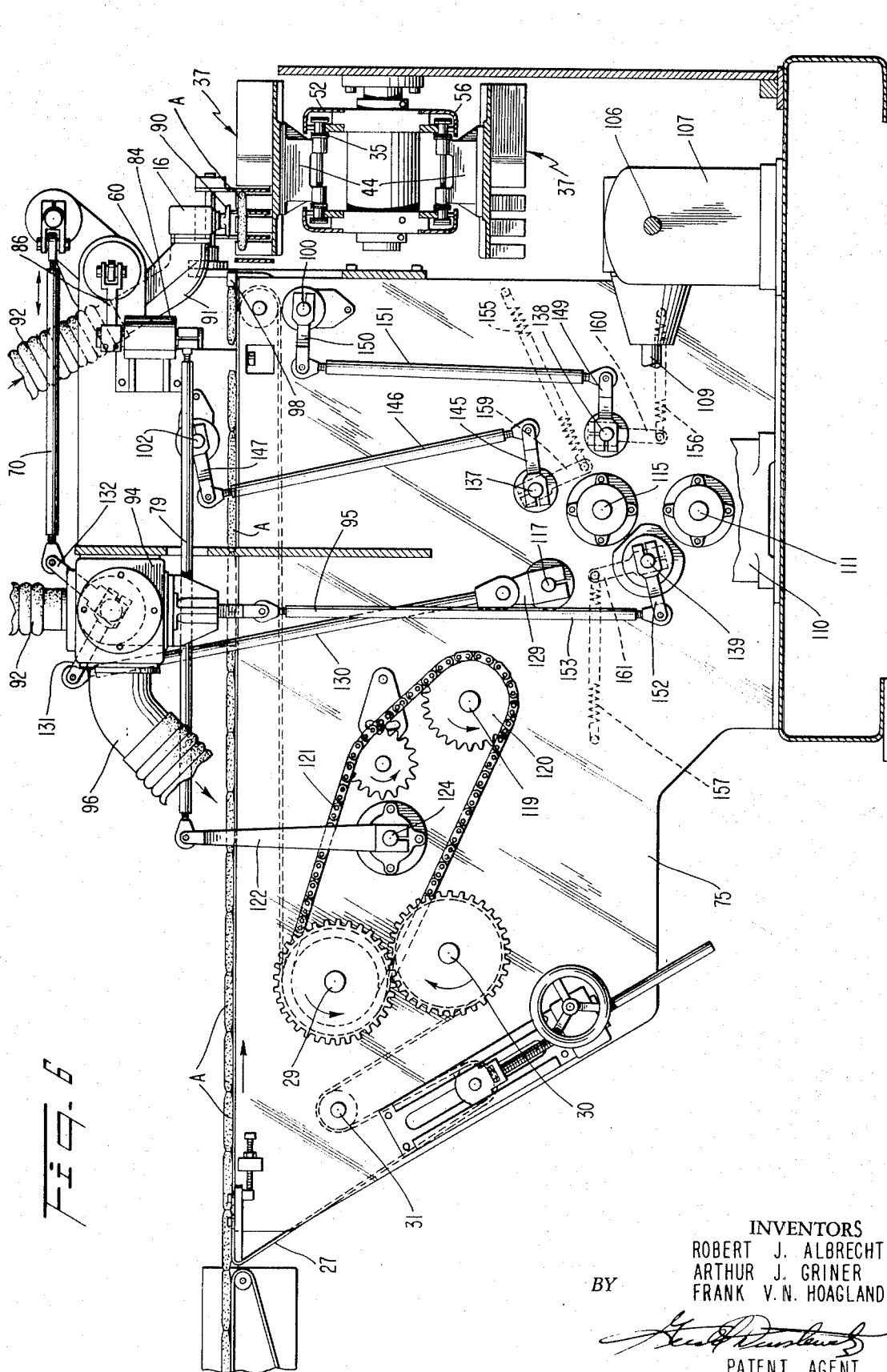
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 9



INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

BY

Handwritten signature
PATENT AGENT

March 6, 1973

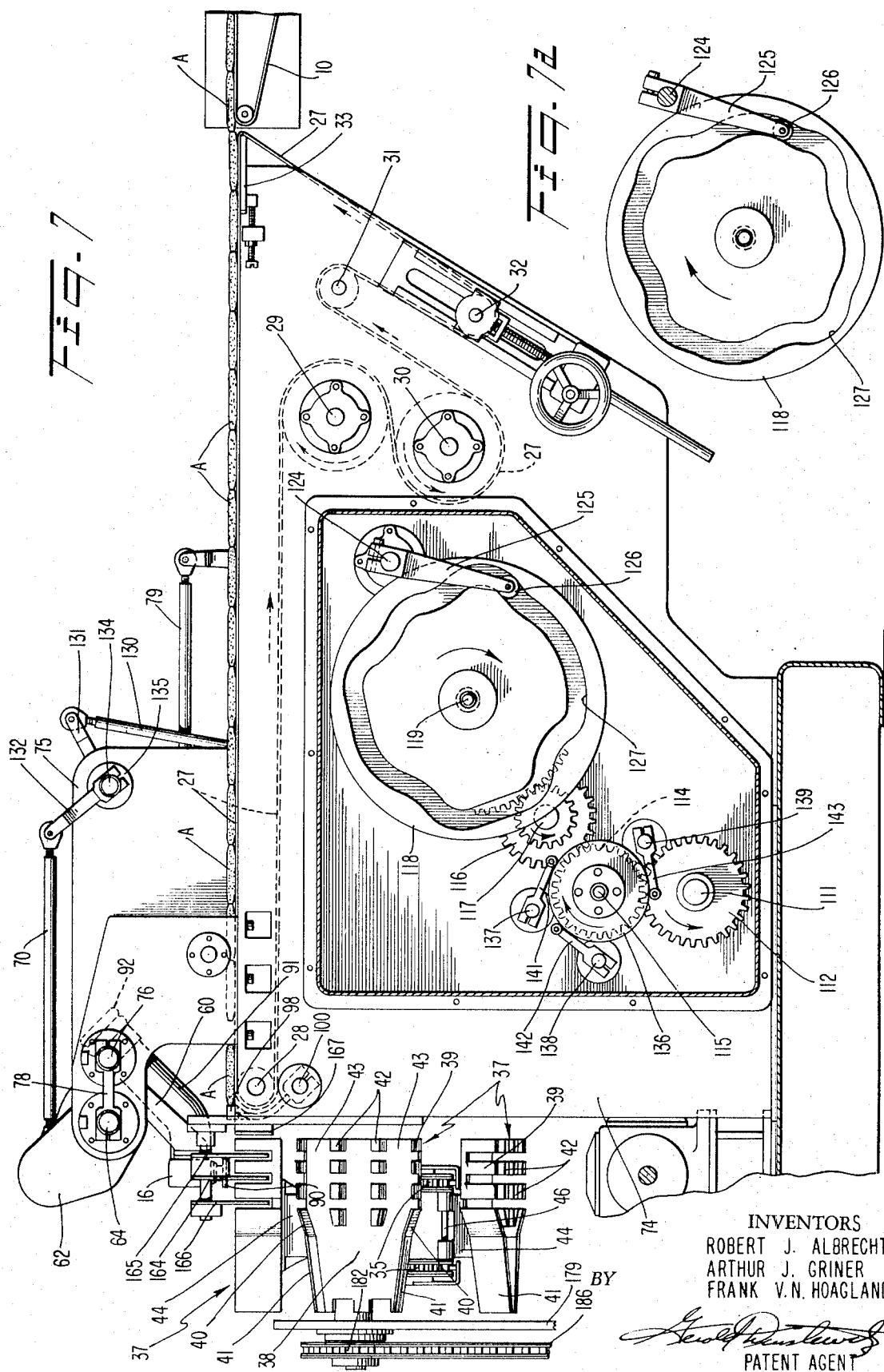
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 10



March 6, 1973

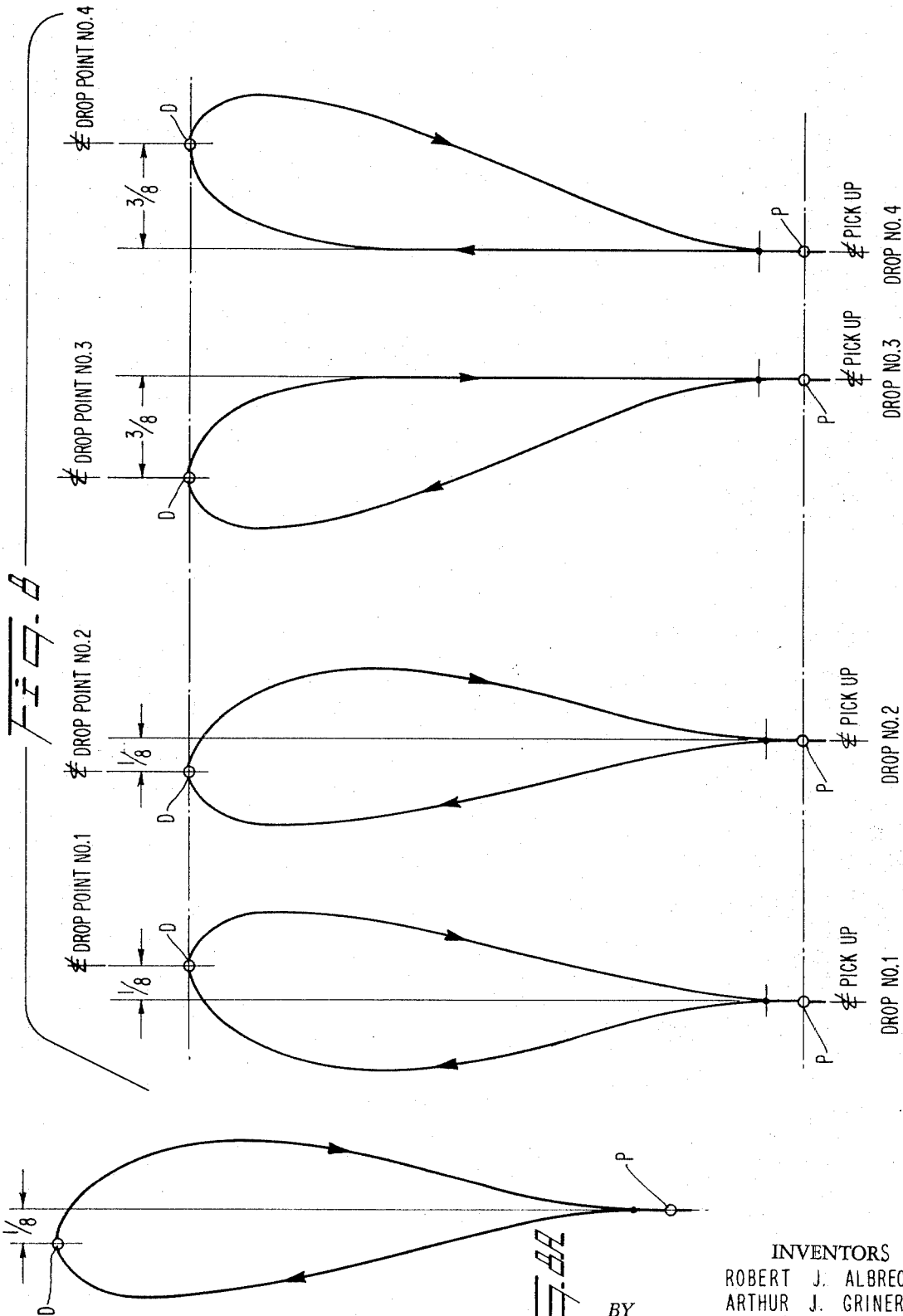
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 11



BY

INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

PATENT AGENT

March 6, 1973

R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 12

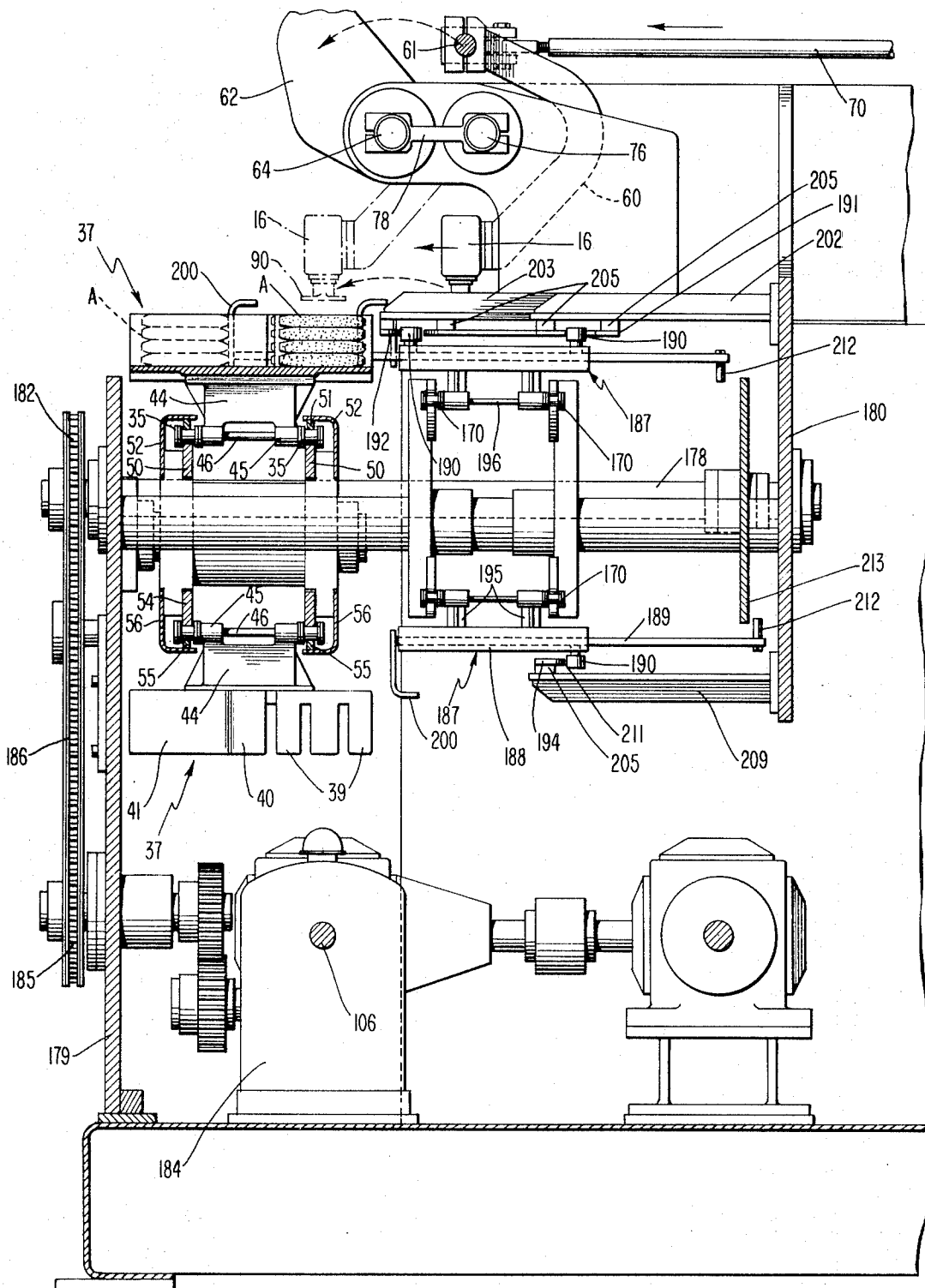


Fig. 10

BY

INVENTORS

ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V.N. HOAGLAND

PATENT AGENT

March 6, 1973

R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 13

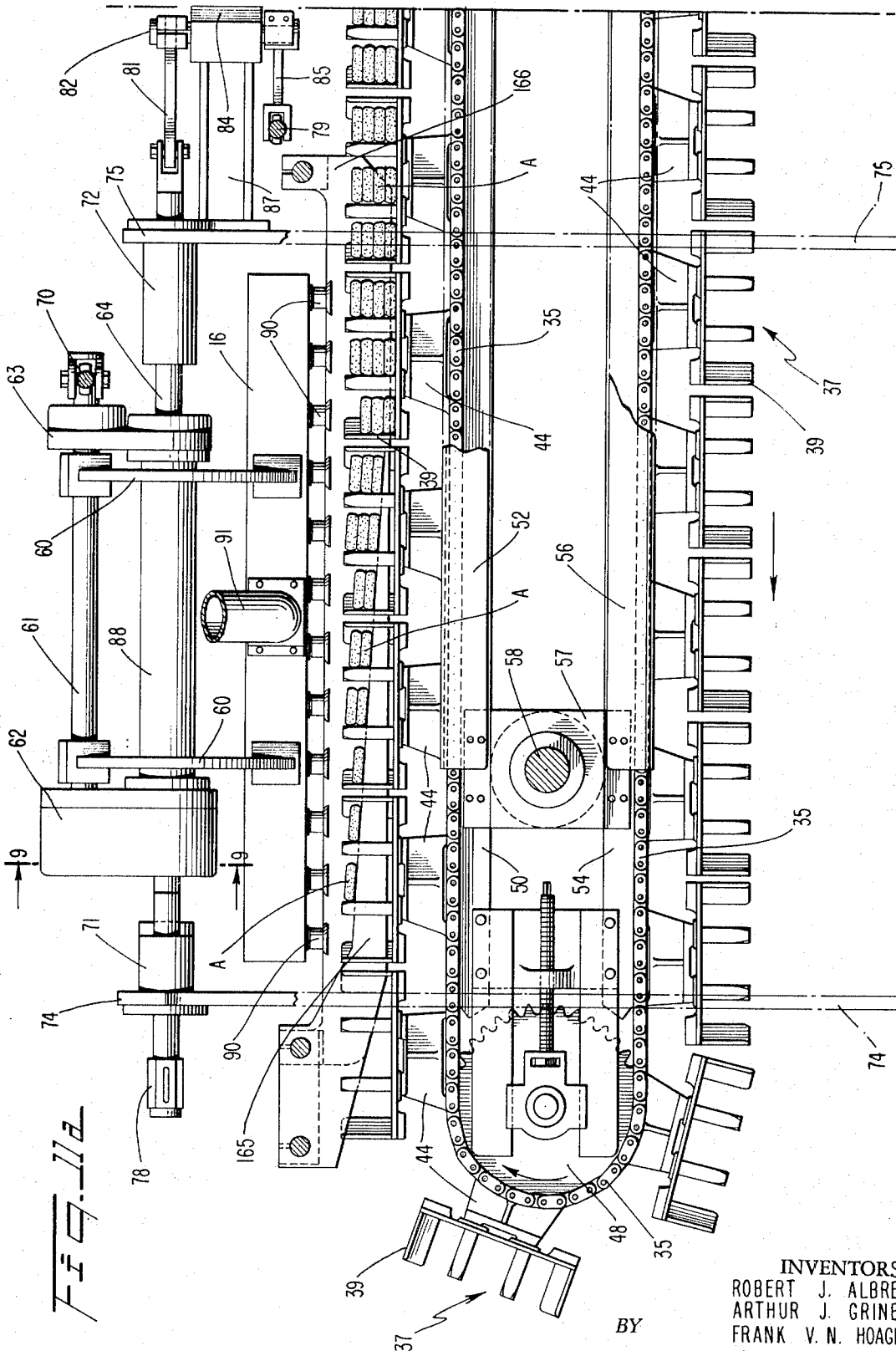


FIG. 11a

INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

BY

Frank V. N. Hoagland
PATENT AGENT

March 6, 1973

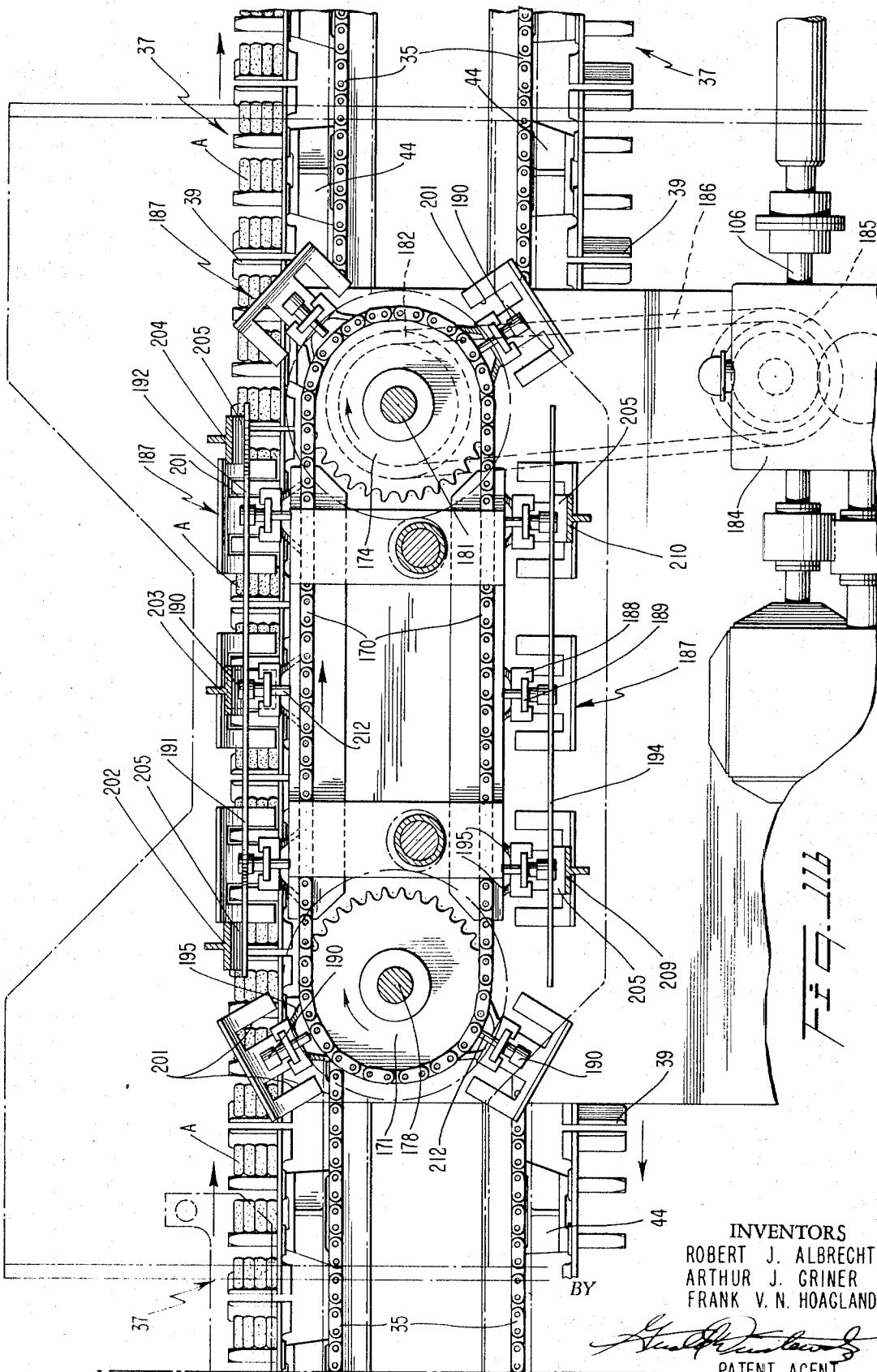
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 14



March 6, 1973

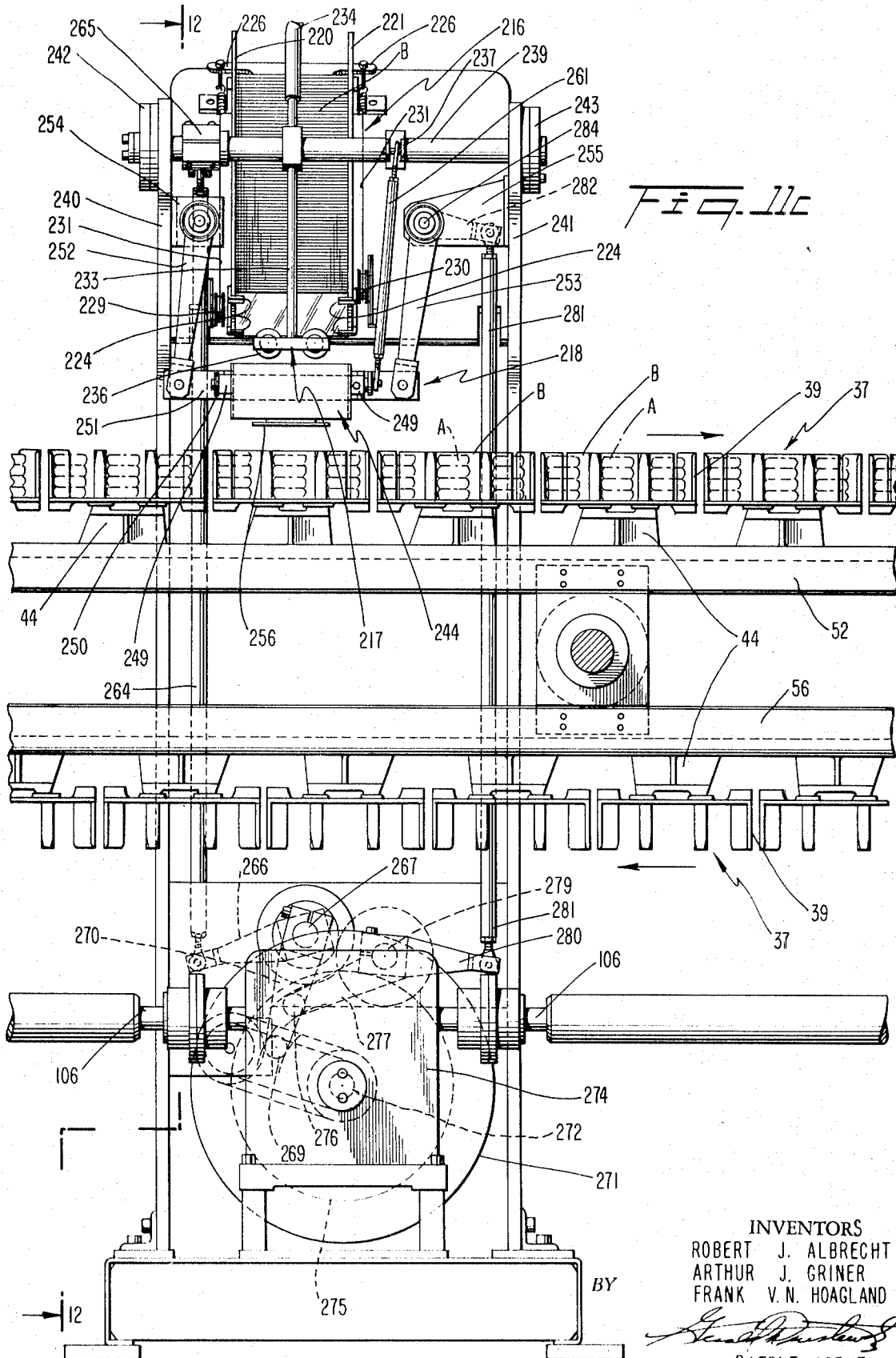
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 16



INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

Robert J. Albrecht
PATENT AGENT

March 6, 1973

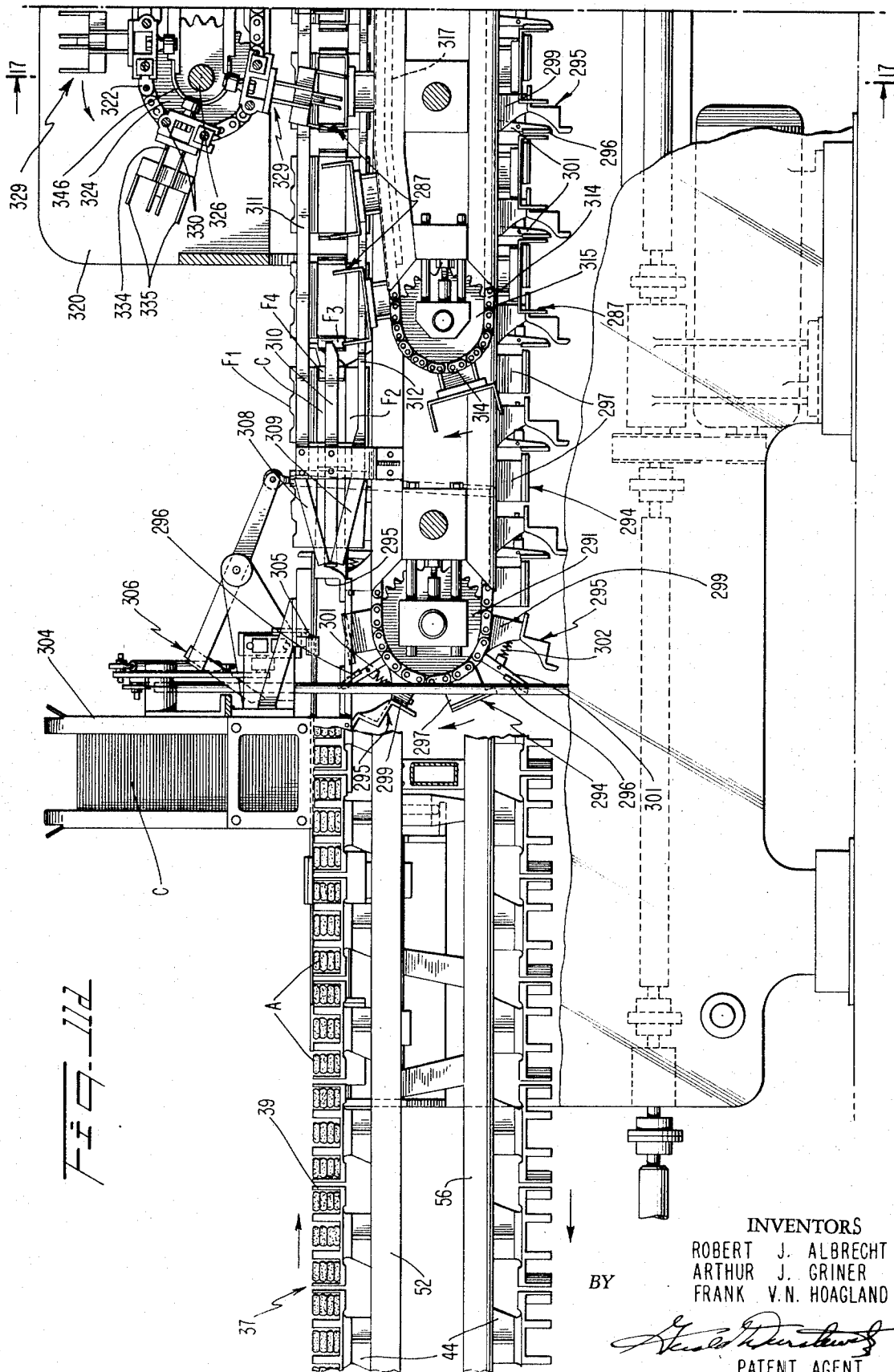
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 16



March 6, 1973

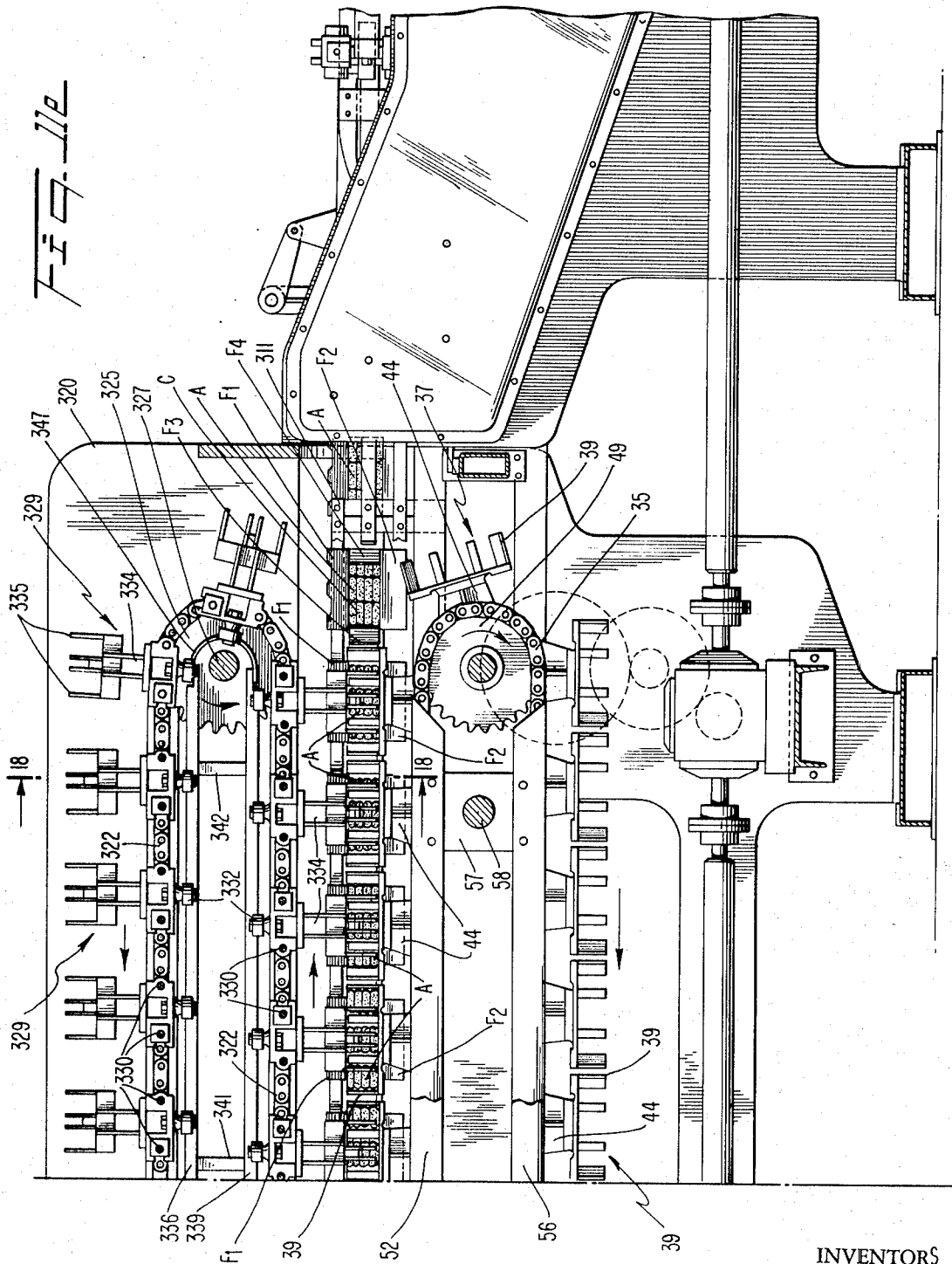
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 17



INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V.N. HOAGLAND
BY
Frank V.N. Hoagland
PATENT AGENT

March 6, 1973

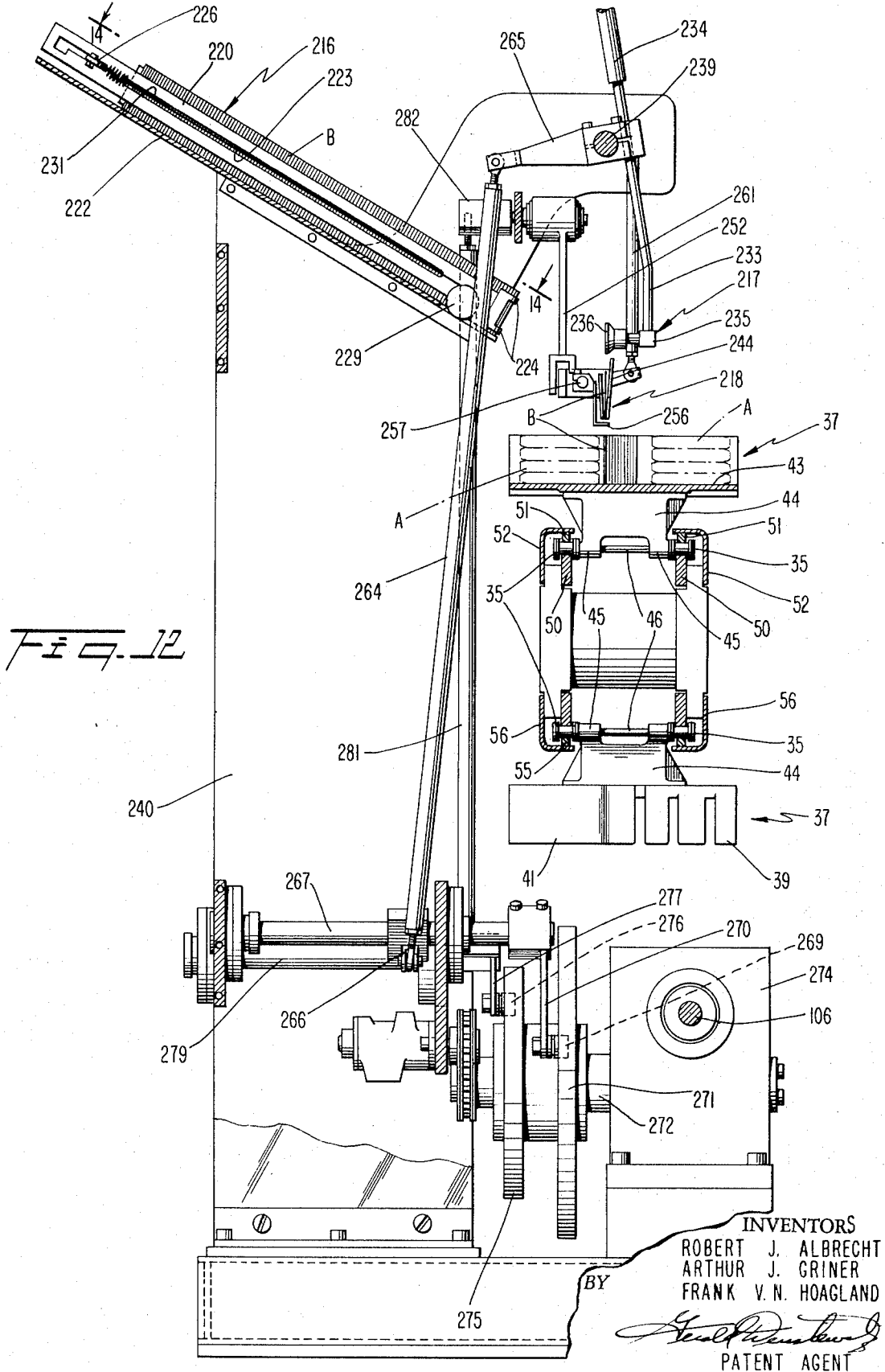
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 18



March 6, 1973

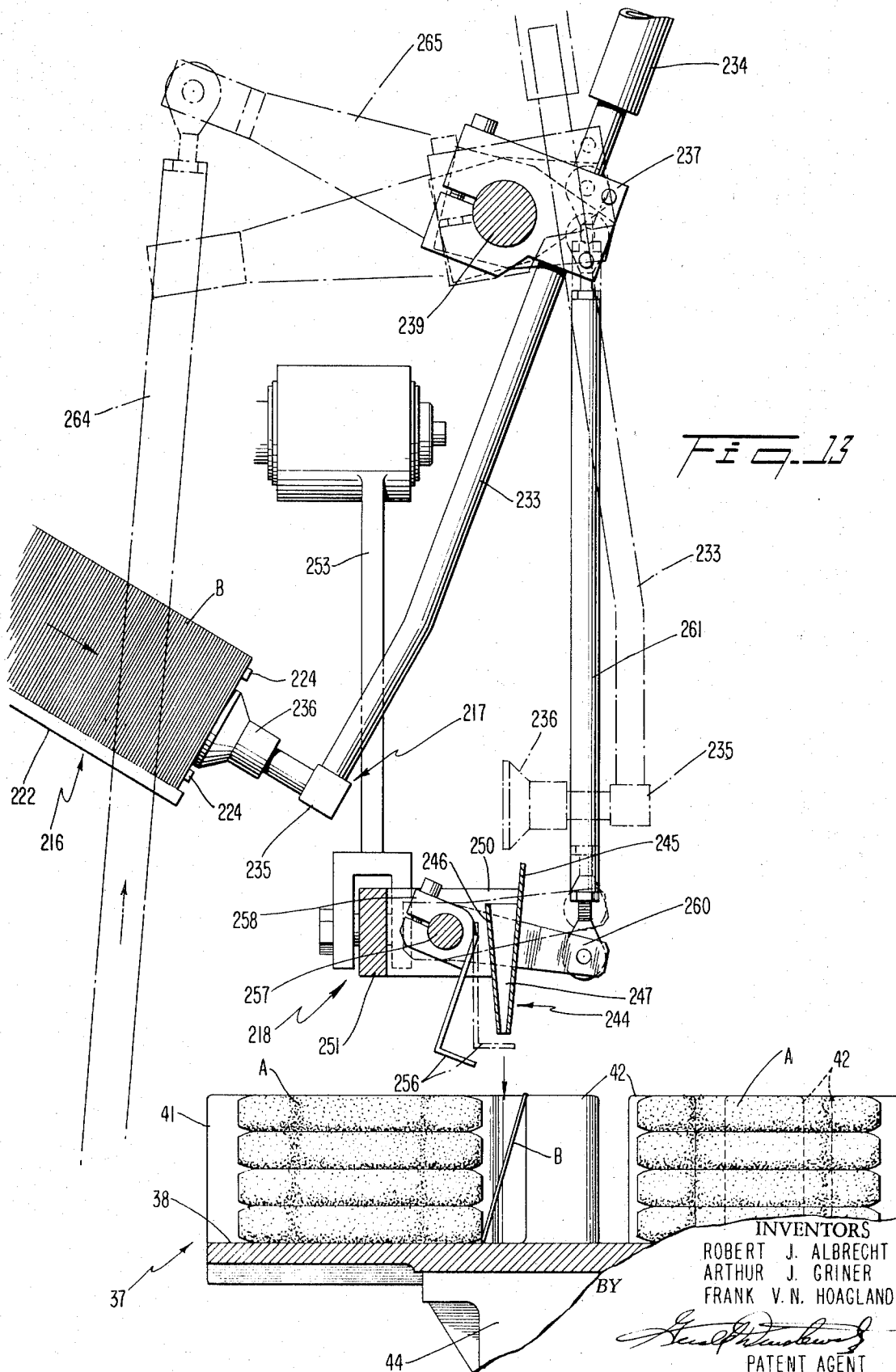
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 19



March 6, 1973

R. J. ALBRECHT ET AL

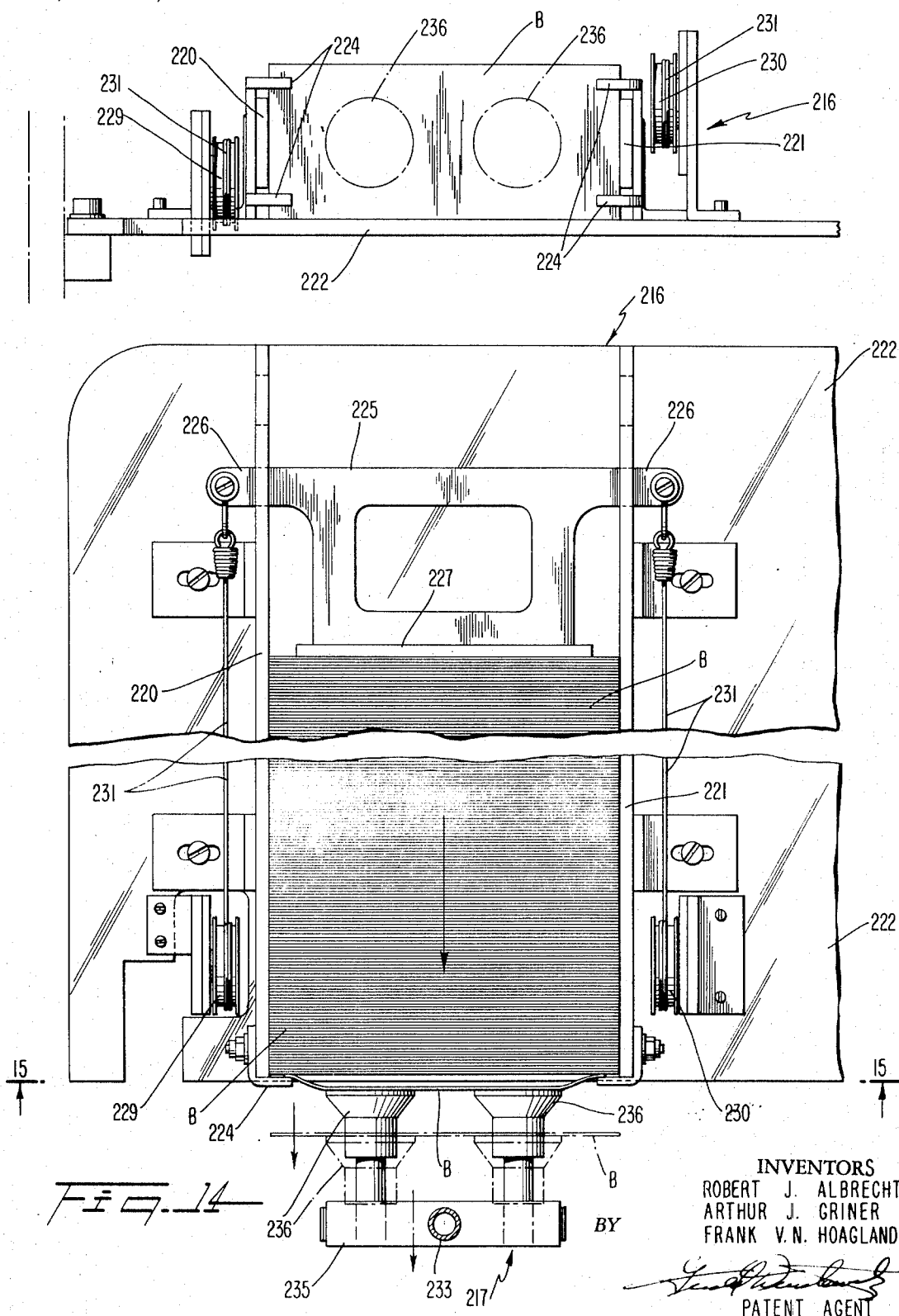
3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 20

Fig. 15



March 6, 1973

R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 21

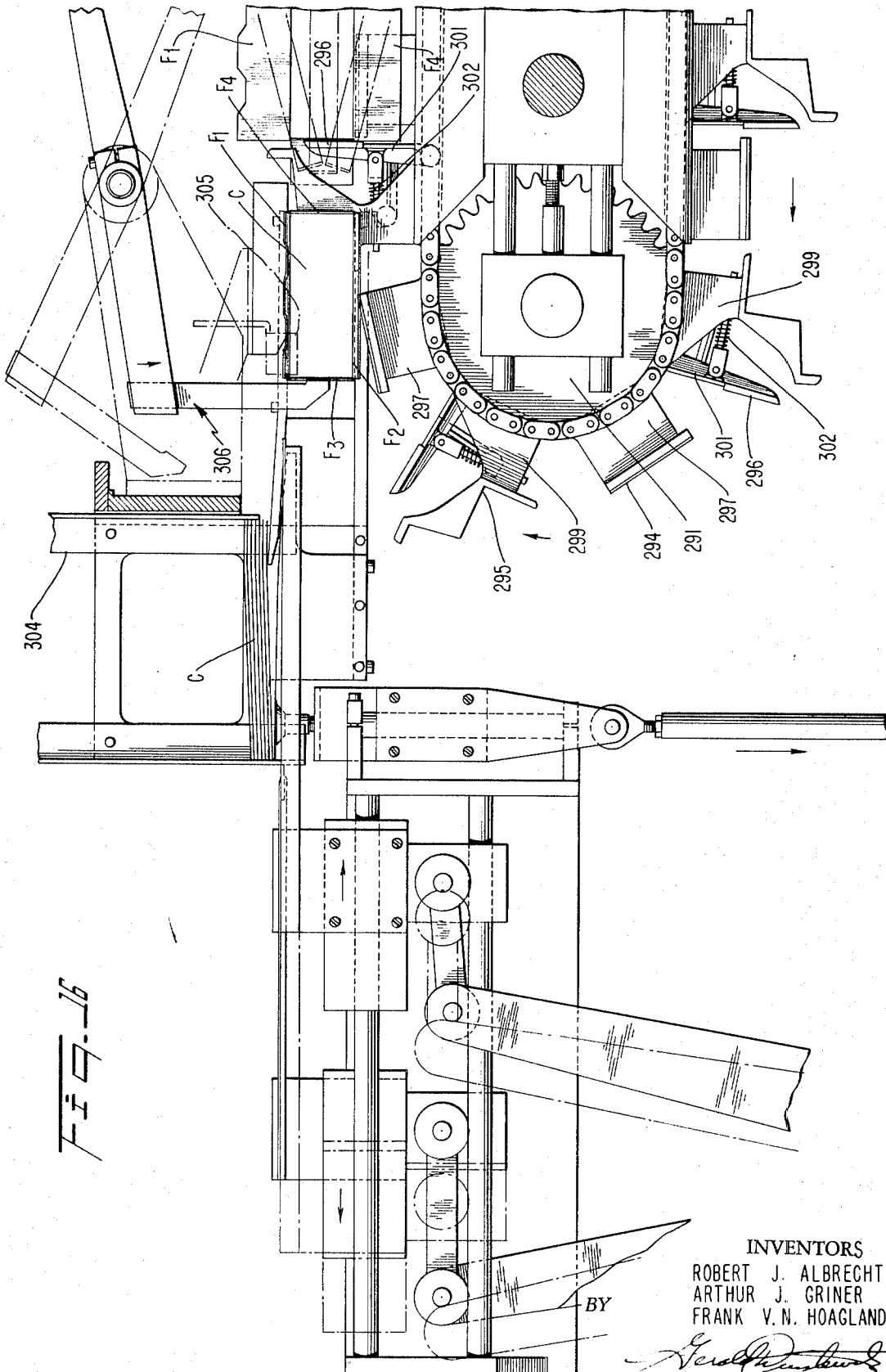


FIG. 16

INVENTORS
ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V. N. HOAGLAND

BY

PATENT AGENT

March 6, 1973

R. J. ALBRECHT ET AL

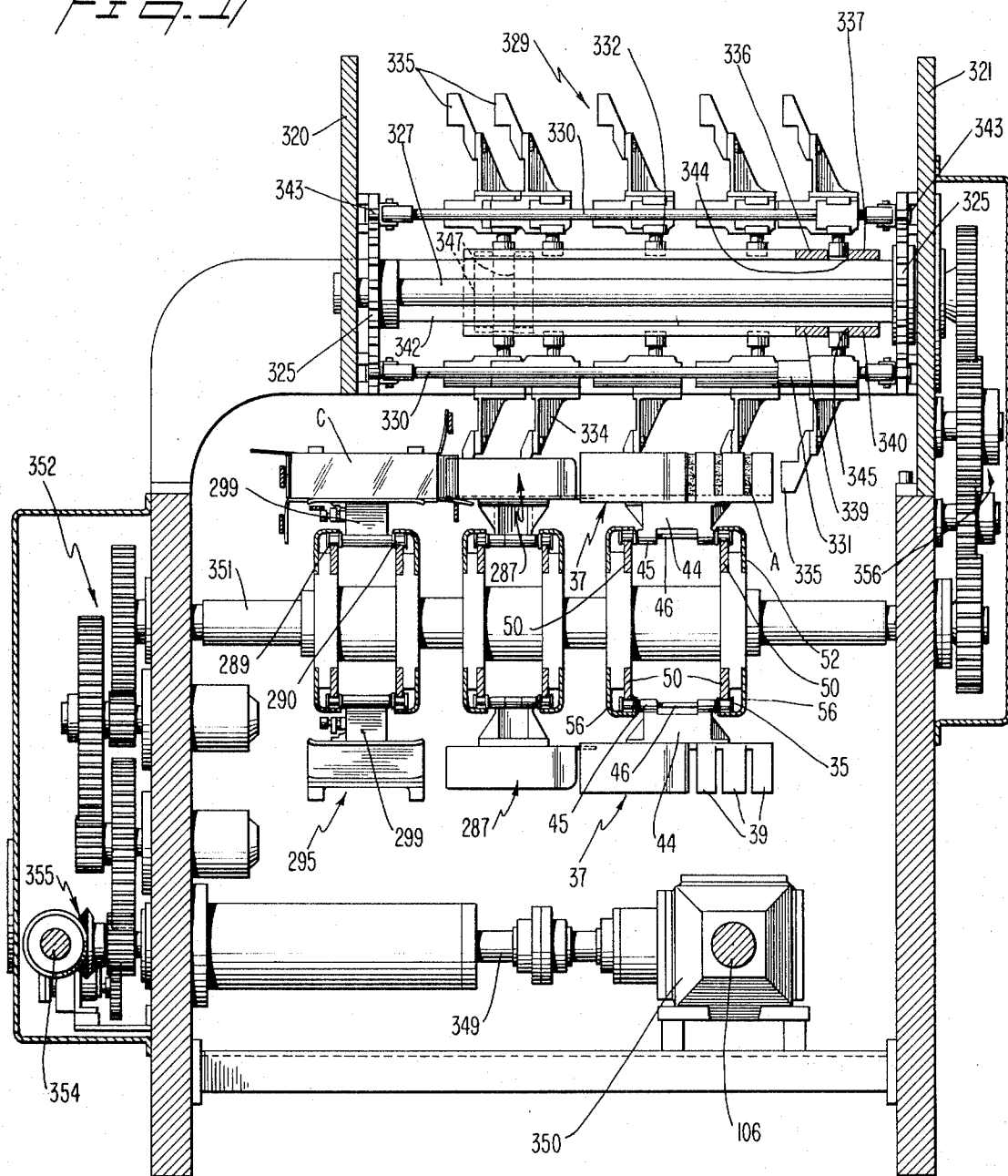
3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 22

Fig. 17



INVENTORS

ROBERT J. ALBRECHT

ARTHUR J. GRINER

FRANK V.N. HOAGLAND

BY

Frank V.N. Hoagland
PATENT AGENT

March 6, 1973

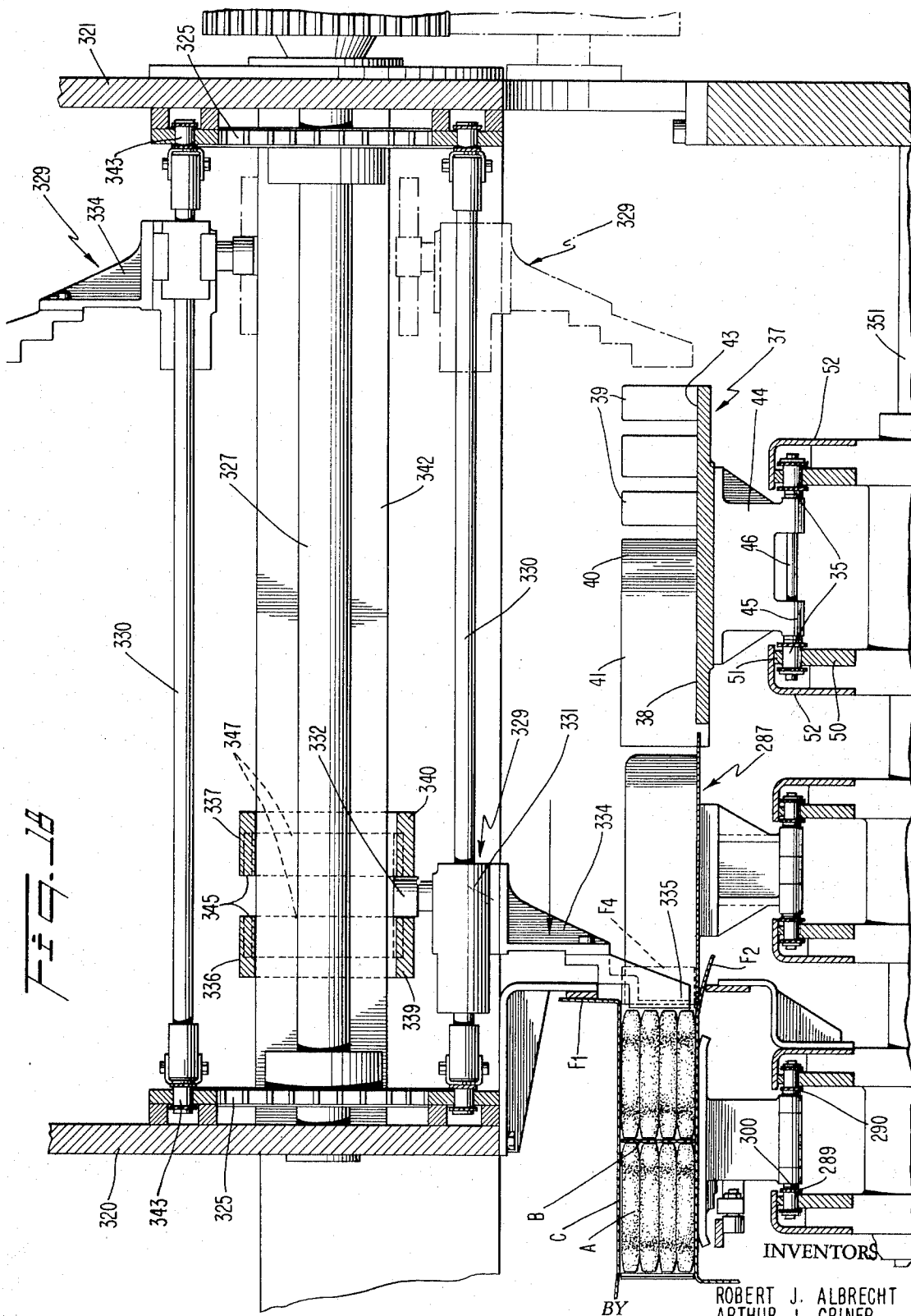
R. J. ALBRECHT ET AL

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE

Filed April 27, 1971

23 Sheets-Sheet 23



INVENTORS

ROBERT J. ALBRECHT
ARTHUR J. GRINER
FRANK V.N. HOAGLAND

PATENT AGENT

1

3,719,019

CONTINUOUS MOTION PACKAGING MACHINE
Robert J. Albrecht, River Edge, Arthur J. Griner,
Wyckoff, and Frank V. N. Hoagland, Fair Lawn, N.J.,
assignors to Nabisco, Inc.

Filed Apr. 27, 1971, Ser. No. 137,124

Int. Cl. B65b 35/30, 35/50

U.S. Cl. 53—159

22 Claims

ABSTRACT OF THE DISCLOSURE

Machinery wherein articles received from a pair of continuously driven plural line infeed conveyors are stacked in two rows upon a main conveyor continuously moving perpendicularly to the infeed conveyors, and groups of these stacks of articles are moved from the conveyor into synchronously moving cartons. An elongated vacuum head repetitively removes articles from the first infeed conveyor and stacks them in a row along the adjacent edge of the main conveyor. This first row is moved transversely across the main conveyor by cam operated pushers moving synchronously with the main conveyor. A second vacuum head at the second infeed conveyor forms the second row of stacked articles. A second set of pushers moves groups of the stacks transversely of the main conveyor through moving chutes into the cartons. The chutes and cartons are carried by conveyors parallel to and synchronized with the main conveyor. The cartons are stored flat in a stack, are removed singly, opened, and gripped between conveyor mounted supports. After being filled, the flaps of the carton are closed and sealed.

BACKGROUND OF THE INVENTION

The present invention relates to packaging machinery, and, more particularly, to such machinery for receiving articles from a conveyor device, arranging the articles in predetermined groups, and moving the groups into cartons.

This invention is most particularly, but not exclusively, concerned with the loading into cartons of articles arranged in two or more layers, each layer consisting of two or more rows and each row containing two or more articles.

In the past, this type of carton loading has been accomplished by the use of intermittently operating machinery wherein time is lost because the operation of one mechanism is suspended during the operation of another mechanism.

An example of this type of prior art machinery is the can boxing machine disclosed in U.S. Pat. 2,127,924. In this machine, cans roll down four vertically stacked ramps into a stacking and carton loading device. A pusher arrangement, moving at right angles to the ramps, pushes three cans from each of the four ramps into a funnel member to form one layer of cans. The pusher retracts and three more cans move down each ramp to fill the void. The pusher moves again, this time through a longer stroke, moving another three cans from each of the ramps into the funnel against the first layer and through the funnel to load the two layers into a carton. Each operation is performed intermittently with lost time separating the consecutive performances of any one operation. The cans on the ramps cannot feed into the loading position during the period in which the pusher is operating, and after the pusher has completed an operation it cannot operate again until additional cans move into the loading position.

2

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a packaging machine capable of rapid operation.

Another object is to provide such a machine which is highly efficient in operation.

Another object is to provide such a machine wherein each operation is performed continuously and the articles being packaged are in continuous motion.

Another object is to provide such a mechanism which receives articles from a conveyor, stacks the articles, arranges the article stacks into groups, and moves the groups into cartons.

Another object is to provide a novel mechanism for receiving articles from an infeed conveyor and stacking them on a continuously moving second conveyor.

Another object is to provide a mechanism capable of producing predetermined stacks from infeed arrangements carrying a number of lines of articles other than an even multiple of the stack height.

Another object is to provide such a mechanism which can be readily adjusted to receive articles from different infeed arrangements.

Another object is to provide a novel arrangement for arranging article stacks into groups.

Another object is to provide a novel mechanism for positioning a divider between portions of each group of articles.

Another object is to provide a novel arrangement for the loading of the group of article into the cartons.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a schematic plan view of a machine according to the present invention;

FIG. 2 is a diagram illustrating, with relation to the article positions on an infeed conveyor, the positions of both the article stack locations on the main conveyor and the transfer stacking head at the end of each of four transfer operations which comprise a complete cycle of transfer operations;

FIG. 3 is a diagram illustrating the article stack location which each of the infeed conveyor lines supplies on each of a number of successive transfer operations;

FIGS. 4a, 4b and 4c are plan views of sections of the machine which when arranged in end to end relationship show the article stacking and grouping portion of the machine;

FIG. 4d is a plan view of the portion of the machine including a mechanism for placing a layer dividing card between the two rows of article stacks;

FIGS. 4e and 4f are plan views of sections of the machine which when arranged in end to end relationship show the carton loading portion of the machine;

FIG. 5 is a sectional view taken along the line 5—5 on FIG. 4a illustrating the operation of the transfer stacking head;

FIG. 6 is a sectional view taken along the line 6—6 on FIG. 1 and FIG. 4b with the pusher mechanism removed to permit an unobstructed view of the mechanism operating the transfer stacking head;

FIG. 7 is an end view partly in section taken along line 7—7 in FIGS. 1 and 4a;

FIG. 7a is a view of a modification of the cam wheel shown in FIG. 7;

FIG. 8 is a diagram illustrating the movement of the transfer stacking head during each of the four operations comprising a full cycle of operation;

3

FIG. 8a is a diagram illustrating the movement of the head during each operation when the cam wheel of FIG. 7a is employed;

FIG. 9 is a sectional end view taken along line 9—9 on FIG. 11a;

FIG. 10 is a sectional end view taken along line 10—10 on FIG. 1 and FIG. 4b;

FIGS. 11a and 11b are elevation views of sections of the machine which when arranged in end to end relationship show the article stacking and grouping portion of the machine shown in plan by FIGS. 4a and 4b;

FIG. 11c is an elevation view of that portion of the machine including the card placing mechanism shown in plan by FIG. 4d;

FIGS. 11d and 11e are elevational views of sections of the machine which when arranged in end to end relationship show the carton loading portion of the machine;

FIG. 12 is a sectional view taken along line 12—12 on FIG. 1 and FIG. 11c showing the dividing card positioning mechanism in one position;

FIG. 13 is an enlarged view of a portion of FIG. 12 showing the mechanism in another position;

FIG. 14 is a view taken along line 14—14 on FIG. 12;

FIG. 15 is a view taken along line 15—15 on FIG. 14;

FIG. 16 is an enlarged view of a portion of FIG. 11d showing the mechanisms therein in a different operative position;

FIG. 17 is a sectional view taken along the line 17—17 on FIG. 11d; and

FIG. 18 is an enlarged view of a portion of the mechanism shown in FIG. 17.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings:

FIG. 1 shows the relative locations of the various conveyors and mechanisms of a machine in accordance with the present invention. Articles are fed to the machine by two parallel delivery conveyors 10 and 11 each carrying eleven continuous parallel lines of articles. The delivery conveyors are positioned in end to end relationship with two infeed conveyors 13 and 14 which form a part of the machine. The ends of the delivery and infeed conveyors are in close proximity so that the articles flow smoothly onto the infeed conveyors.

A continuously moving main conveyor 15 on which the articles are stacked and arranged in groups is positioned perpendicular to the infeed conveyors. Two transfer stacking mechanisms are positioned adjacent the ends of the infeed conveyors and include elongated vacuum heads 16 and 17 which move reciprocally between the infeed conveyors and the main conveyor.

On each of its operations, the vacuum head 16 picks up one article from each of the eleven lines of articles on the conveyor 13 and deposits the articles in a row along the adjacent side of the main conveyor 15. The movement of the head is related to the movement of the conveyor 15 so that, as described hereinafter in detail, repeated operations of the head stacks article is four high upon the conveyor 15.

Between the infeed conveyors, a cam operated pusher mechanism 19 is positioned to move, in groups of three, the stacks of articles from the side of the conveyor 15 adjacent to the infeed conveyors to the other side of the conveyor 15.

The head 17 operates in a manner identical to the head 16 and stacks articles four high along the adjacent side of the conveyor 15 to form a second row of articles. A group of six stacks of articles, three from each row comprise the contents of one carton.

A mechanism 20 positioned further along the conveyor 15 deposits a layer dividing card between the two rows of stacks in each group.

Further along the conveyor 15 there is provided a carton loading section in which a carton feeding and opening

4

mechanism 21 delivers open cartons to a continuously moving conveyor 22 which moves the cartons in alignment with the groups of stacked articles on the conveyor 15. Between the conveyor 22 and the conveyor 15 there is positioned a conveyor 24 carrying guiding chutes aligned with the article stack groups and the cartons. A second cam operated pusher mechanism operating throughout the length of the conveyor 24 moves each group of articles from the conveyor 15 through the chutes and into the cartons. The cartons are subsequently closed and sealed and deposited on a conveyor 26.

Infeed conveyors 13 and 14

Referring now to FIGS. 4a, 4b, 4c and 7 the infeed conveyors 13 and 14 are identical and each comprise an endless wide fabric belt 27 which extends (as shown in FIG. 7) around a series of five rollers mounted on shafts 28 to 32 and over the edge of a plate 33. Each of the belts 27 receive from the delivery conveyors (10, 11) eleven lines of articles A disclosed herein as bone shaped dog biscuits and have a width sufficient to accommodate twelve lines of these articles. The belts 27 are continuously driven by the rollers on the shafts 29 and 30 as described hereinafter.

Conveyor 15

The conveyor 15, as best shown in FIGS. 4a, 4b, 5, 10 and 11a comprises a pair of parallel endless link chains 35 upon which are mounted a series of receptacles or bucket members 37. The bucket members have a floor 38, three spaced side wall segments 39 on each side of the end adjacent the conveyors 13 and 14, rapidly converging central side wall sections 40, and gently converging end side wall sections 41.

The bucket members are provided with four pair of partition members 42 spaced between the wall segments 39 and between the wall sections 40 to divide the inner half of the bucket floor into three areas or stacking locations 43 each sized to accommodate one of the articles A. The partition members 42 are aligned with the wall segments 39 and the wall sections 40 to provide three slots extending across the bucket members to accommodate loading rails as described hereinafter. The partition members 42 have a thickness equal to the distance separating adjacent buckets 37 so that the stacking locations 43 are equally spaced throughout the conveyor.

The bucket members 37 are each fastened to a box shaped support 44 provided on each side with a pair of bushings 45 carrying a rod 46 the ends of which are fitted into the chains 35. The chains each extend between sprocket wheels 48 on one end (FIG. 11a) and driven sprocket wheels 49 (FIG. 11e) at the other end. Between the sprocket wheels 48 and 49, the upper portion of the chains ride between a lower rail 50 and an upper rail 51 which is carried by a cover member 52 (FIG. 10). In the same manner, the lower portion of the chains ride between an upper rail 54 and a lower rail 55 which is carried by a cover member 56. The rails 50 and 55 and the cover members 52 and 56 are secured to plates 57 which are supported by shafts 58.

Transfer stacking mechanisms

In the transfer stacking mechanism associated with the infeed conveyor 13 as shown in FIGS. 4a, 4b and 11a, the elongated vacuum head 16 is supported by two arms 60 which are clamped to a shaft 61. The shaft 61 extends between a gear box 62 and a bearing block 63 both of which are carried by a shaft 64 parallel to the shaft 61. Within the gear box 62 as shown in FIG. 9 a pair of gears 66 and 67 are rigidly mounted on the shafts 61 and 64 respectively and both engage a gear 68 which is journaled to the case of the bearing box. A rod 70 secured to the shaft 61 is given a horizontal reciprocating motion by mechanisms described hereinafter to impart to the vacu-

5

um head an arcuate motion between the conveyor 13 and the conveyor 15 as shown in FIG. 5.

The shaft 64 is mounted for axial movement in bearings 71 and 72 which are carried by frame members 74 and 75 respectively. A second shaft 76 (FIG. 4a), parallel to the shaft 64, is mounted for axial movement in a bearing 77 carried by the frame member 74. A bar 78 is clamped to the shafts 64 and 76 to lock the shafts against rotation while permitting free axial movement. The shaft 64 is axially positioned by movement of a rod 79 (FIGS. 6 and 4b) acting through a crank assembly 80 and a link 81. The crank assembly 80 includes a vertical shaft 82 mounted in a bearing 84 and having horizontally extending arms 85 and 86 clamped to opposite ends thereof. The bearing 84 is carried by a supporting arm 87 extending from the frame member 75.

The shaft 64 is encased within a sleeve 88 upon which the bearing blocks 63 and casing 62 are mounted. The sleeve 88 is journaled about the shaft 64 so that the casing 62 and the block 63 may rotate about the axis of the shaft 64 which is itself locked against rotation. As the casing 62 is rotated in this by the motion of the rod 70, the gears 68 and 66 rotate the shaft 61 so that the head 16 keeps the articles in a horizontal position as they are transferred from the conveyor 13 to the conveyor 15.

The vacuum head 16 is a hollow rectangular box provided with twelve downwardly extending nozzles 90 and a centrally positioned vacuum conduit 91. The conduit 91 is connected by means of a flexible hose 92 to a valve 94 (FIGS. 6 and 4b) which is opened and closed by a rod 95. The valve 94 is connected to a vacuum pump (not shown) by means of a conduit 96.

At the start of each operation of the transfer stacking mechanism, the head 16 is in the position shown in solid lines in FIG. 5, the valve 94 is open and articles A are held by suction against the nozzles 90. The rods 70 and 79 are operated as described hereinafter in detail to move the head 16 both over the bucket members and along the line of motion of the bucket members. The valve 94 is then closed to cut off the vacuum and vent the hose 92 so the articles are deposited in the bucket members and the rods 70 and 79 are then operated to return the head to the original position.

At the beginning of each operation of the transfer stacking mechanism, the articles A to be transferred during that operation are positioned along a loading line defined by a bar gate 98. The bar 98 is carried by arms 99 which are clamped to a rotatable shaft 100. When the bar 98 is in the position shown in solid lines on FIG. 5, it holds the articles against the action of the continuously moving belt. The other articles on the conveyor are held back by a pin gate 101 which is mounted on a rotatable shaft 102. As the vacuum head 16 begins its movement toward the bucket 37, the shaft 100 is rotated counterclockwise to drop the bar 98 and release the articles carried by the head 16. While the head 16 is in motion, the shaft 100 is rotated clockwise to raise the bar 98 and the shaft 102 is rotated clockwise to release another row of articles (one in each line). The row of released articles are carried by the conveyor to the bar 98 while the gate 101 is returned to its original position to engage the next article in each line. The gate 101 includes a bar 104 extending across the conveyor 13 above the articles, and a pair of pins 105 for each of the lines of articles. As shown in FIG. 4a each pair of pins is spaced to straddle the central portion of the dog biscuits A and engage the enlarged end sections.

The mechanisms for controlling the motions of the head 16 (both transverse and axial) and for controlling the operation of the gates 98 and 101 are shown in FIGS. 6 and 7.

A main drive shaft 106 (FIG. 6) extends from the main motor in the area of the sprocket wheels 49 to a gear box 107, an output shaft 109 extends from the gear box (at right angles to the shaft 106) into a gear box 110

6

(only the base of which is shown). The gear box 110 has an output shaft 111 parallel to the main drive shaft 106, which as shown in FIG. 7, carries a gear 112 on its far end. The gear 112 drives a gear 114 mounted on a rotatable shaft 115; a compound gear 116 mounted on a rotatable shaft 117 is driven by the gear 114 and drives a grooved cam wheel 118 mounted on the shaft 119. Referring again briefly to FIG. 6, a sprocket wheel 120 is mounted on the other end of the shaft 119 and drives a link chain 121 to rotate the shafts 29 and 30 through the gears shown and thus drive the conveyor 13. The rod 79 is joined to a lever 122 mounted on a rotatable shaft 124. On the other end of the shaft 124 (FIG. 7) a lever arm 125 carries a cam follower wheel 126 which engages a cam groove 127 in the wheel 118. As the wheel 118 rotates, the shaft 124 is rotated or rocked according to the contour of the groove 127 to move the head 16 parallel to the conveyor 15. The transverse motion of the head 16 is provided by the rotation of the shaft 117 with the driven gear 116. As shown in FIG. 6, the shaft 117 is connected to the rod 70 through a crank arm 129, a rod 130, and a crank assembly including arms 131 and 132 clamped to opposite ends of a shaft 134 (FIG. 7) journaled in a bearing 135 carried by the frame member 75.

The operations of the pin gate, the bar gate and the vacuum valve 94 are controlled by a cam wheel 136 bolted to the gear 114 (FIG. 7). Three rotatable shafts 137, 138 and 139 are positioned around the gear 114 and carry cam follower arms 141, 142 and 143 respectively. Referring to FIG. 6, the shaft 137 is connected by means of a crankarm 145, a rod 146, and a crankarm 147 to the shaft 102 to control the pin gate. The shaft 138 is similarly connected to the shaft 100 by means of crank arms 149, 150 and a rod 151 to control the bar gate; and the shaft 139 is connected to control the valve 94 by means of a crank arm 152 and a rod 153. Each of the shafts 137, 138 and 139 are provided with a return spring 155, 156 and 157 respectively acting upon a lever arm 159, 160 and 161 respectively to hold the cam follower arms 141, 142 and 143 against the cam wheel 136.

The cam wheel 136 (FIG. 7) and the shaft 117 each rotate four times during every revolution of the cam wheel 118. Each rotation of the shaft 117 produces the same transverse motion of the head 16 and each rotation of the cam wheel 136 causes the bar gate, the pin gate and the valve to operate in exactly the same sequence and manner. The longitudinal motion of the head 16 on each of the four transfer operations performed during one revolution of the wheel 118, is controlled by the shape of the groove 127.

The infed conveyors 13 and 14 are of sufficient width to accept 12 lines of articles A and the heads 16 and 17 are provided with 12 nozzles, one for each of these lines. When 12 lines of articles are received from the delivery conveyors, all of the twelve nozzles are utilized and the cam wheel 118 shown in FIG. 7a is employed wherein the groove 127 has four sections of identical shape. The longitudinal motion of heads 16 and 17 is then identical on each transfer operation. FIG. 8a illustrates the longitudinal and transverse motion of one of the nozzles during a transfer operation, the vertical movement of the nozzle being in an arc as shown in FIG. 5. The point P represents the center of the nozzle as it engages an article held at the load line by the bar gate 98. The point D represents the center of the nozzle as it releases the article into a conveyor bucket 37.

In moving from point P to point D the head 16 first moves against the direction of motion of the conveyor, and then reverses its longitudinal motion moving in the direction of motion of the conveyor. As the article approaches point D, its longitudinal speed equals that of the conveyor and at the point D the valve 94 is operated to cut off vacuum and drop the article into the conveyor bucket. Between points D and P, the longitudinal motion

of the nozzle is slowed and then reversed to bring the nozzle back to the pickup point P.

During each operation, 12 articles are delivered to the conveyor 15 and the conveyor 15 moves three article positions between subsequent drops. Thus each article position receives articles four times during its transit past the head 16 resulting in the stacking of articles four high on each article location.

When less than 12 lines of articles are delivered to the infeed conveyors, a four high stacking of articles on each of the article locations can be achieved by providing a cam wheel 118 with a groove 127 which on subsequent operations places the head 16 at different longitudinal positions when it reaches its furthest transverse point (at which the articles are dropped).

The cam wheel 118 in use on the machine as disclosed in FIG. 7 is designed to move the head 16 so as to receive articles from eleven lines and stack the articles four high on each of the article stack locations 43 of the conveyor 15. The gearing driving the conveyor 15 is chosen so that the conveyor 15 moves $2\frac{3}{4}$ article stack locations, during each transfer operation and therefore eleven locations during four transfer operations.

Referring to FIGS. 8 and 2, FIG. 8 shows the motion of one of the nozzles 90 during each of the four transfer operations which take place during one revolution of the cam wheel 118 shown in FIG. 7. In each of the four diagrams the pickup point P represents the center of a nozzle as it engages an article held by the bar gate and the point D represents the center of the nozzle when the article is released to drop into a conveyor bucket 37. FIG. 2 illustrates the relative longitudinal positions of the transfer head 16 and the conveyor 15 locations (indicated by the numbers 1 to 11) with respect to the infeed conveyor 13 at the time the articles are dropped on to the conveyors 15 (point D on FIG. 8).

On the first transfer operation, the eleven active nozzles deposit articles on conveyor locations positioned $\frac{1}{8}$ of a location width to the right of the pickup points. The locations numbered 1, 2, and 3 in FIG. 2 receive their first articles on this operation. On the second operation each nozzle the drop point is positioned $\frac{1}{8}$ of a location width to the left of the pickup point P. Between these two drops, the conveyor 15 has moved $2\frac{3}{4}$ location widths to the right while the nozzles have moved $\frac{1}{4}$ location width to the left. Therefore, with respect to the nozzles, the conveyor has moved three locations to the right. Thus conveyor locations numbered 4, 5 and 6 receive their first articles and conveyor locations 1, 2 and 3 receive their second layer of articles.

On the third transfer operation each nozzle is positioned, at the drop point, $\frac{3}{8}$ of a location width to the left of the pickup point. The head has therefore again moved $\frac{1}{4}$ location width to the left while the conveyor has moved $2\frac{3}{4}$ locations to the right so that the conveyor has moved three location widths to the right with respect to the head. On this operation conveyor locations 7, 8 and 9 receive their first layer of articles, locations 4, 5 and 6 receive their second layer of articles and locations 1, 2 and 3 receive a third layer of articles.

On the fourth operation, the nozzles are moved to the right so that at the drop point they are $\frac{5}{8}$ of a location width to the right of the pickup point. The head therefore moved $\frac{3}{4}$ of a location width to the right while the conveyor has moved $2\frac{3}{4}$ location widths to the right. The resulting relative movement of the conveyor with respect to the head 16 is two location widths. As a result, conveyor locations 1, 2 and 3 receive their fourth level of articles, locations 4, 5 and 6 receive their third level of articles, locations 7, 8 and 9 receive their second level of articles and locations 10 and 11 receive their first level.

During the four transfer operations, the head 16 is moved equal distances in opposite directions along the conveyor. Therefore, the net movement of the conveyor with

respect to the head during a cycle of operation is eleven locations.

With reference to FIG. 2, of the eleven lines of articles on the infeed conveyor 13, the first and second, fourth and fifth, seventh and eighth, and tenth and eleventh lines (counting from the left edge) always respectively supply first, second, third and fourth level articles to locations 43. The third, sixth, and ninth lines supply respectively first, second and third level articles on the first three transfer operations, and, on the fourth transfer operation, they respectively supply second, third, and fourth level articles.

The diagram of FIG. 3 shows which conveyor locations 43 are supplied by each of the eleven lines of articles on eight successive transfer operations. In each instance the location 43 is shown in alignment with the line of articles which supplies the article added during that operation. It is to be understood that such alignments do not in fact exist and are shown in FIG. 3 only to correlate the receiving location with the supplying line. In FIG. 3 the locations 43 are divided into groups which after each operation contain the same number of stacked articles. The locations numbered 1, 2, 3 form one such group, three other groups being formed by locations numbered 4, 5, 6, 7, 8, 9 and 10, 11.

It will be seen from FIG. 3 that with respect to the article lines, the conveyor effectively moves three locations on each of the first, second and third transfer operations. Therefore, on each of these operations the first three lines supply first level articles, the next three lines supply second level articles, the following three supply third level articles, and the final two supply fourth level articles. On the fourth operation, the conveyor effectively moves only two locations with respect to the article lines. The third, sixth and ninth article lines on this operation supply articles to locations which have already received respectively the first, second and third level articles. Therefore, on this operation these lines supply the second, third and fourth level articles.

As shown in FIG. 5, the nozzles 90 release the articles A at the level of the top of the wall segments 39. To minimize the distance which the articles drop upon their release, a pair of tapered rails 164 and 165 are mounted to extend between the wall segment 39 as shown in FIGS. 4a, 5, and 11a. The taper of the rails provides a sloping upper surface upon which the articles are deposited. The slope of this surface is related to the number of articles stacked at different positions along the rails so that the articles released by each of the nozzles drop only a short distance. As the buckets 37 move past the infeed conveyor, the wall segments 39 and the partition members 42 of the buckets engage the articles and slide them along the rails as additional layers of articles are added. The stacks of articles are deposited upon the floor 38 of the buckets at the point where the rails terminate, after which, the fourth and final layer of articles is added.

To keep the articles in proper transverse position while sliding along the rails, inner and outer vertical guides 166 and 167 are provided. As best shown in FIG. 5, the inner guide 167 extends along the inner edge of the bucket 37 while the outer guide 166 extends between the wall sections 40 and the adjacent wall segments 39.

Cam operated pusher mechanism 19

Referring now to FIGS. 4b, 10 and 11b, the pusher mechanism 19 includes a pair of endless link chains 170 each mounted on sprocket wheels 171 and 174. The sprocket wheels 171 are mounted upon a shaft 173 which is carried by frame members 179 and 180. The sprocket wheels 174 are mounted upon a shaft 181 which is journaled to the frame members 179 and 180 and carries a sprocket wheel 182 on the end adjacent the frame member 179. A gear box 184 powered by the main shaft 106 drives a sprocket wheel 185 which is connected by a chain 186 to the sprocket 182 to drive the link chains 170 at the same speed as the buckets 37. The chains 170 carry

a plurality of pusher assemblies 187 each including a rectangular sleeve member 188 and a pusher bar 189 slideably mounted in the sleeve member 188. The pusher bar has a cam wheel 190 mounted thereon for cooperation with a pair of cam elements 191 and 192 mounted over the chains and a cam element 194 mounted under the chains. The sleeve member 188 is provided with two pairs of legs 195, and a rod 196 extends through the legs into the joints of the chain links to secure the sleeve member to the chains. The sleeve member 188 is provided with a longitudinal slot 197 to accommodate the cam wheel 190, and the pusher bar 189 is provided with a head 199 having a vertical face 200 provided with a pair of spaced slots 201 which align with the partition members 42 of the buckets 37. The cam elements 191 and 192 are mounted to the underside of T-shaped beams 202, 203 and 204 by means of spacer blocks 205. The beams 202, 203, and 204 are mounted on the frame member 180 and extended toward the conveyor 15. The element 191 extends between the beams 202 and 203 at an angle toward the conveyor 15 and provides a cam surface 206. As each pusher bar moves under the cam element 191, the cam wheel thereon rolls along the surface 206 and slides the bar toward the bucket 37 aligned therewith. The front face 200 of the pusher head 199 engages the three stacks of articles in the buckets and moves them across the buckets to the area between the converging walls 41. The cam element 192 extends between the beams 203 and 204 at an angle away from the conveyor and provides a cam surface 208 for returning the bars to their retracted position. The cam element 194 is mounted upon a pair of T-shaped beams 209 and 210 and spaced therefrom by means of spacer blocks 205. This element is parallel to the direction of motion of the chains and is provided with a surface 211 for engaging the cam wheels to hold the pusher bars in their retracted position while the pusher assemblies are carried through the lower portion of the chain circuit. The pusher bars are each provided with a pin 212 in the end opposite the head 199 to cooperate with circular discs 213 and 214 mounted on the shafts 178 and 181 to maintain the bars in the fully retracted position as the pusher assemblies are carried around the sprocket wheels (171-174).

The pusher mechanism 19 thus moves the stacks of articles formed by the first transfer stacking mechanism across the buckets to enable the second transfer stacking mechanism to form stacks of articles on the locations 43 as shown in FIG. 4c and the buckets, each containing 24 articles, are then carried by the mechanism 20. The second transfer stacking mechanism shown in FIGS. 4b and 4c is constructed as a "mirror image" of the first transfer stacking mechanism and operates so as to move the vacuum head through exactly the same patterns as the head 16 is moved.

In the drawings, the parts of the second transfer stacking are assigned the same reference numbers as the corresponding parts of the first mechanism with a prime notation added thereto. For example, the second mechanism has arms 60' and shafts 61' and 64.

Dividing card mechanism 20

With reference to FIGS. 4d, 11c, 12, 13, 14, and 15 the mechanism 20 includes a card magazine 216, a vacuum picking head 217 for removing cards B from the magazine one at a time and a card aligning mechanism 218 for moving each card in synchronism with the conveyor 15 and dropping it into a bucket between the first loaded stacks of articles and the second loaded stacks of articles.

The card magazine 216 includes a pair of side walls 220 and 221 which are mounted on a plate 222 and are each provided with a longitudinal slot 223. Four fingers 224 are mounted on the side walls at the discharge end of the magazine to normally retain the stacks of cards in the magazine against the action of a card pusher 225.

The pusher 225 is formed with ears 226 extending through the slots 223 and carries a plate 227 bearing against the upper end of the card stack. The pusher 225 is actuated by a pair of spring loaded drums 229 and 230, each of which has a cable 231 secured to and wrapped about the outer surface of the drum. Within the drums, helical springs urge the drums to rotate so as to tension the cables 231.

The vacuum picking head 217 includes a pipe 233 connected to a flexible vacuum hose 234, a manifold 235 on the end of the pipe 233 and two suction nozzles 236 extending from the manifold. The pipe 233 passes through and is carried by a clamp 237 which is mounted on a shaft 239. The shaft 239 extends between a pair of frame members 240, 241 and is rotatably mounted in bearings 242, 243 carried by the frame members.

The card aligning mechanism 218 includes a temporary storage chamber 244 which tapers from the top to the bottom and comprises a pair of spaced converging walls 245, 246 extending along the direction of motion of the conveyor 15 and side walls 247. The wall 245 furthest from the card magazine is provided with extensions 249 which connect to a pair of arms 250 extending from a bar 251. The bar 251 is carried by two pivoted arms 252, 253 which are respectively supported by brackets 254, 255 secured to frame members 240, 241. The cards in the chamber 244 rest upon an "L" shaped gate member 256 which is secured to a rotatable shaft 257 by means of a clamp 258. The shaft 257 extends through the arms 250 and a lever arm 260 is clamped on one end thereof. A rod 261 connects the lever arm 260 to a short lever arm 262 clamped to the shaft 239. The shaft 239 is rotated back and forth by a rod 264 connected to a lever arm 265 clamped to the shaft.

When the rod 264 moves upward the shaft 239 rotates to bring the suction nozzles 236 against the end card in the magazine 216. At the same time the rod 261 rotates the shaft 257 to pivot the gate 256 away from the chamber 244 allowing the card therein to drop. When the rod 265 moves downward the card is carried by the picking mechanism to a position over the chamber 244 while the gate 256 is rotated to the card supporting position. The flexible hose 234 is connected to the vacuum source through a rotary valve (not shown) which is timed with the operation of the picking head so that vacuum is released when the card is positioned over the chamber 244. The card thus drops into the chamber to be released upon the next upward movement of the rod 264.

The rod 264 is connected to a lever arm 266 which is clamped upon a shaft 267 near the base of the machine. The shaft 267 is oscillated by the interaction of a cam follower 269, carried by an arm 270 clamped to the shaft, and a groove in a cam wheel 271 mounted on the output shaft 272 of a gear box 274 which is driven by the main power shaft 106.

A second grooved cam wheel 275 is mounted on the shaft 272 and cooperates with a cam follower 276 carried by an arm 277 which is clamped to a rotatable shaft 279. A second arm 280 clamped to the shaft 279 is connected by means of a rod 281 to an arm 282 adjacent the pivoted arm 253. The arms 253 and 282 are rigidly secured to opposite ends of a shaft 284 which extends through and is supported by the bracket 255.

The rotation of the cam wheel 275 imparts to the shaft 279 an oscillating motion which moves the rod 281 vertically in a reciprocating manner. The reciprocating motion of the rod 281 causes the chamber 244 to move back and forth parallel to the conveyor 15. The grooves in the cam wheels 275 and 271 are formed so that the rod 281 is moved upwardly to move the chamber 244 along with each passing bucket while the rod 264 is also moving upwardly to release the card B carried in the chamber. The motion of the chamber 244 and the gate 256 are synchronized with the conveyor 15 so that the card drops into the passing bucket. The rod 281 is then moved

downwardly to return the chamber to the position shown in FIG. 11c and the rod 264 is moved downwardly to deposit another card in the chamber.

Carton loading section

The carton loading section of the machine is shown in FIGS. 4e, 4f, 11d, 11e, 16, 17 and 18. In this section of the machine, the conveyors 22 and 24 respectively move empty cartons C and guiding chutes 287 in alignment with each other and with the buckets 37 of the conveyor 15. While the buckets, the chutes and the cartons are moving in alignment, a pusher mechanism slides the stacks of articles from the buckets through the chutes and into the cartons.

The conveyor 22 includes a pair of endless link chains 290 extending between a pair of sprocket wheels 291 and a pair of sprocket wheels 292 (FIG. 1). The sprockets 292 are driven. Mounted between the link chains 290 throughout their length are a series of sets of carton holding elements, each set including (as shown in FIGS. 11d and 16) a central platform element 294, a combined platform and end wall element 295 preceding and facing the element 294, and a spring loaded end wall element 296 facing the element 294 and pivotally mounted at the leading end of the element 295 following the element 294. The elements 294 and 295 are mounted respectively on bases 297 and 299 which are attached between the chains 290 by rods 300. The element 296 is mounted on an arm 301 which is held by the forward one of the rods 300 supporting the base 299. A spring 302 is mounted between the arm 301 and the base 299 to hold the arm 301 generally perpendicular to the link chains.

As the carton holding elements 295, 294 and 296 are carried around the sprocket wheels 291, the curvature of the link chains and the spacing of the elements from the chains (by the bases and the arm 301) results in a separation of the elements. As each element 295 reaches the top of the sprocket wheels 291, the carton feeding and opening mechanism places an open carton between the elements 295 and 296 as shown in FIG. 16. The open carton is gripped between the elements 295 and 296 as the spacing therebetween is reduced when the chains straighten out upon moving off the sprocket wheels 291.

The carton feeding and opening mechanism 20 is generally of the type shown in U.S. Pat. 1,746,836. The cartons C are stored flat in the hopper 304 with the end flaps pointing toward and away from the viewer of FIGS. 11d and 16. The cartons are stripped from the bottom of the stack one at a time and the stripped carton is held by a pair of horizontal blades 305 which extend crosswise of the conveyor 22 and are moved toward each other to enter the folded carton from each open end. While the carton is thus supported by the blades 305, an arm 306 is activated to engage the side wall of the folded carton and swing it downwardly to open the carton. The element 296 engages the side wall of the carton and presses the carton against the element 295 whereupon the blades 305 are retracted.

With reference particularly to FIG. 11d, the carton has four end flaps F1, F2, F3, F4 on the end facing the conveyor 15. As the carton is moved along by the conveyor 22, a pair of diverging guides 308 and 309 engage and bend the flaps F1 and F2 upward and downward respectively into vertical positions. A short central horizontal guide 310 bends the flaps F3 and F4 to the left (as viewed in FIG. 11d). The flaps F1 and F2 are held in the vertical positions by horizontal guides 311 and 312. After a short movement of the carton, the flap F4 is released by the guide 310 and springs back to its original position. As the flap F3 reaches the end of the guide 310, a chute 287 is moved between the flaps F3 and F4 and is aligned with the carton.

The conveyor 24 carrying the chutes 287 includes a pair of endless link chains 314 extending between sprocket wheels 315 and 316. The sprockets 316 are mounted on

the same driven shaft carrying the sprockets 49 of the conveyor 15. The sprockets 315 are of smaller diameter than the sprockets 316, and as the chains leave the sprockets 315 they ride up inclined rails 317 to raise the chutes 287 into position between the flaps F3 and F4 and into alignment with the cartons and the buckets.

The adjacent edges of the buckets and the chutes are provided with interlocking notches (shown in FIG. 4e) to insure a proper alignment therebetween. The chutes 287 are mounted on legs 319 positioned between and supported by the chains 314. The sprockets 48, 49, 291, 292 and 316 are all of the same diameter and the legs and bases 44, 297, 299, 301, and 319 are of the same vertical height to place the open cartons, the guiding chutes and the buckets at the same vertical level.

The second pusher mechanism is mounted above the conveyors 15, 22 and 24 between frame members 320, 321 and includes a pair of endless link chains 322 each extending around sprocket wheels 324 and 325. The sprockets 324 are mounted on a freely rotatable shaft 326 and the sprockets 325 are mounted on a driven shaft 327. A plurality of pusher members 329 carried by the chains 322 are each slideably mounted upon a pair of rods 330 which extend between and are secured to the chains. Each of the pusher members 329 includes a block 331 which is slideably mounted upon the rods 330 and has a cam follower wheel 332 mounted thereto. An arm 334 extends from the block and is provided with fingers 335 for engaging the article stacks. An upper pair of elongate cam members 336, 337 and a lower pair of elongate cam members 339, 340 are mounted on a pair of cross tie bars 341, 342 which extend between the frame members 320 and 321. The upper and lower cam members are identically shaped and vertically aligned to form upper and lower vertically aligned cam paths 344 and 345. The ends of the cam paths 344 and 345 are joined by paths formed between a pair of semi-circular cam members 346 and 347 provided at the sprockets 324 and 325.

As shown in FIG. 20, the main drive shaft 106 drives a lateral shaft 349 through a gear box 350. The shaft 349 drives the shaft 351 through a gear train 352 and drives a shaft 354 through a set of bevel gears 355 (FIG. 4f). The shaft 354 drives the carton feeding and opening mechanism 20. The shaft 354 carries the driving sprockets 49 and 316 (of the conveyors 15 and 24) and drives the shaft 327 of the second pusher mechanism through a gear train 356.

The link chains 322 are driven at the same speed as the conveyor 15 and move the pusher members 329 in synchronism with the buckets 37. As the pusher members move with the buckets (from the sprockets 324 toward the sprockets 325) they are moved laterally along the rods 330 toward the carton conveyor 22 by the engagement of the cam follower wheels 332 in the lower cam path 345. The fingers 335 engage the article stacks on the locations 43 and slide the six stacks of articles from the bucket through the chute and into the carton. When the push members reach the sprockets 325 they are inverted and are repositioned on the rods 330 by the upper cam path 344.

The filled cartons are moved by the conveyor 22 past flap closing guides and sealing devices well known to the art and the sealed cartons are deposited on the conveyor 26. Although the machine described herein is specifically designed for packaging dog biscuits, it is to be understood that by merely changing the construction of the gate 101 any article having approximately the same overall dimensions could be packaged by the machine, and the dimensions of the machine could be varied to package almost any article.

It will be seen from the foregoing that the present invention provides a highly efficient and rapidly operating packaging machine in which the articles being packaged are in continuous motion and novel mechanisms are pro-

vided including a stacking mechanism capable of arranging articles received from a number of infeed lines into stacks of a predetermined height wherein the number of infeed lines is other than an even multiple of the stack height.

We claim:

1. Article stacking apparatus comprising in combination means for delivering articles to a plurality of loading positions along a line, conveyor means continuously moving parallel to said line and having locations on which articles are to be stacked, transfer means for simultaneously moving articles from each of said loading positions to an equal number of said conveyor locations means for driving said transfer means repetitively through a cycle of operations, each cycle consisting of a number of transfer operations equal to the number of articles to be stacked on each location, each transfer operation consisting of the movement of articles along a path having components perpendicular to and parallel with said conveyor, said conveyor means being driven so as to move a predetermined number of locations past a stationary point during each transfer operation, said predetermined number of locations being equal to the number of loading positions divided by the number of articles in a stack, the movement of said transfer means parallel with said conveyor during each transfer operations being such so as to render the effective conveyor movement with respect to said transfer means a whole number of locations during each transfer operation and a number of locations equal to the number of loading positions during a cycle of transfer operations.

2. Article stacking apparatus according to claim 1 wherein said transfer means moves each of the articles between a pickup point at the loading line and a drop point at the conveyor, and the effective conveyor movement is the relative movement of the conveyor with respect to the transfer means during the time interval between successive drop points.

3. Article stacking apparatus according to claim 2 wherein said transfer means includes a moveable transfer head and said means for driving said transfer means includes first cam means for controlling the motion of said transfer head perpendicularly to said conveyor and second cam means for controlling the motion of said transfer head parallel to said conveyor, said first cam means being formed to produce the same components of motion on each transfer operation, said second cam means being formed with a separate cam section for each of the transfer operations within a cycle of operations.

4. Article stacking apparatus according to claim 3 wherein the number of loading positions is other than a number evenly divisible by the number of articles stacked on each location, and at least two of said cam sections of said second cam means are different to cause the conveyor movement with respect to the transfer means to be a different whole number of locations on the transfer operations controlled by the said two different cam sections.

5. Article stacking apparatus according to claim 3 wherein said means for delivering articles to said loading positions along said line includes a conveyor moving perpendicularly to said line and having a width encompassing all of the loading positions, gate means for holding articles at said loading line until engaged by said transfer head, and cam operated means for rendering said gate means ineffective once during each transfer operation.

6. Article stacking apparatus according to claim 3 wherein said transfer means includes an elongate vacuum head having a vacuum nozzle aligned with each of the loading positions, a shaft above and parallel to said head, means mounting said head to said shaft, a second shaft parallel to and below said first shaft, means for mounting said first shaft upon said second shaft to be moveable in an arc about said second shaft to move said head in an arc between said loading line and said conveyor.

7. Article stacking apparatus according to claim 6 wherein said second shaft is locked against rotation and said last mentioned means includes a first gear mounted on said first shaft a second gear mounted on second shaft, and an idler gear interconnecting the first and second gears.

8. Article stacking apparatus according to claim 6 wherein said second shaft is mounted to be moveable along its axis parallel to said conveyor to move said head parallel to said conveyor.

9. Article stacking apparatus comprising in combination means for delivering articles to a plurality of loading positions along a line, conveyor means moving parallel to said line and having locations on which articles are to be stacked, the number of loading positions being other than a number evenly divisible by the number of articles stacked on each location, transfer means for simultaneously moving articles from each of said loading positions to an equal number of said conveyor locations, means for driving said transfer means repetitively through a cycle of operations, each cycle consisting of a number of transfer operations equal to the number of articles to be stacked on each location, each transfer operation consisting of the movement of articles along a path having components perpendicular to and parallel with said conveyor, said conveyor means being driven so as to move past a stationary point during each transfer operation a predetermined number of locations equal to the number of loading positions divided by the number of articles in a stack, said transfer means being moved parallel with said conveyor during said transfer operations so as to render the effective conveyor movement with respect to midtransfer means a whole number of locations during each transfer operation and a number of locations equal to the number of loading positions during a cycle of transfer operations.

10. Article stacking apparatus comprising in combination means for delivering articles to a plurality of loading positions along a line, conveyor means moving parallel to said line and having a surface providing locations on which articles are to be stacked, transfer means for simultaneously moving an article from each of said loading positions to an equal number of conveyor locations, said conveyor means being driven so as to move a predetermined number of locations past a stationary point during each operation of said transfer means, said predetermined number of locations being equal to the number of loading positions divided by the number of articles in a stack, said number of loading positions and said movement of said conveyor means being such that articles simultaneously supplied to different locations on each transfer operation constitute different levels within the article stacks formed thereon, said transfer means being constructed to release all articles at a uniform vertical distance above said conveyor surface, and a stationary rail member of progressively decreasing height positioned along said conveyor over said surface for supporting the article stacks being formed a distance above said conveyor surface which decreases as the stack height is increased.

11. Apparatus according to claim 10 including wall members on said conveyor means extending vertically between adjacent location for engaging said article stacks being formed to slide said stacks along said rail member.

12. Apparatus for stacking articles and grouping stacks of articles for loading into cartons comprising in combination first and second article supply means spaced from each other for continuously delivering articles into a plurality of loading positions along first and second lines respectively, conveyor means parallel to said lines continuously moving along each of said lines having an inner edge adjacent to said lines and having an outer edge, said conveyor means being provided with a row of article locations adjacent said inner edge and a row of article

15

locations adjacent said outer edge, first and second transfer means at said first and second lines respectively for repetitively transferring articles from each of said loading positions to said article locations, each of said transfer means operating at a rate to stack a predetermined number of articles on each of said inner locations as said locations move along said respective line, transverse repositioning means between said first and second article supply means for moving the articles stacked by said first transfer means to said outer locations to clear said inner locations for the stacking articles by said second transfer means.

13. Apparatus according to claim 12 wherein said first and second transfer means move articles along a path having components perpendicular to said conveyor and parallel with said conveyor to synchronize the motion of the articles with the motion of the conveyor.

14. Apparatus according to claim 12 including second conveyor means for moving cartons parallel with said first conveyor means and in synchronism therewith, and second transverse repositioning means for moving articles from said inner and outer locations transversely of said first conveyor into said cartons.

15. Apparatus according to claim 14 wherein said first conveyor includes a series of receptacles each having a wide floor portion at said inner edge providing a number of spaced article locations of said inner row a narrow floor portion at said outer edge providing an equal number of article locations of said outer row, and side walls for guiding the movement of said article stacks across said floor portions.

16. Apparatus according to claim 15 wherein said first and second transverse repositioning means engage the inner edge of the articles stacked on said inner locations and push the article stacks across said receptacles, said second transverse repositioning means being constructed to move article stacks from the inner locations past the outer locations off the receptacle.

17. Apparatus according to claim 16 including means for depositing a separating element in said receptacles between the articles stacked on the inner locations and the articles stacked on the outer locations before the operation of said second transverse repositioning means.

18. Apparatus according to claim 17 wherein said means for depositing a separating element includes means for temporarily storing a separating element over said first conveyor, means for moving said storing means parallel with said first conveyor in synchronism with each of said receptacles, and means for releasing said separating ele-

16

ment from said storage means when said storage means is synchronized with a receptacle.

19. Apparatus according to claim 16 including a third conveyor means positioned parallel to and between said first and second conveyor means, a plurality of chute members secured to said third conveyor, said third conveyor being in synchronism with said first and third conveyors to place said chuted member in alignment with said receptacles and said cartons, said second transverse repositioning means being constructed to move the article stacks through the chute member and into the cartons.

20. Apparatus according to claim 12 wherein said transverse repositioning means includes a repositioning conveyor parallel to said conveyor means, said positioned between said first and second transfer means, article stack engaging elements mounted on the repositioning conveyor to be moveable transversely across said conveyor means while moving in parallel synchronism therewith, cam means extending along the length of the repositioning conveyor for moving the article engaging elements transversely of said first conveyor.

21. Apparatus according to claim 19, wherein said cam means is formed to move said article engaging elements from the inner edge of said conveyor means transversely to reposition said articles on the outer locations and to return said elements to the inner edge of said conveyor means while said elements are moving from said first transfer means toward said second transfer means.

22. Apparatus for depositing separating elements between groups of articles on a moving conveyor comprising in combination means for storing a quantity of separating elements, means positioned above the conveyor for temporarily storing a separating element, means for removing a separating element from said storage means and depositing it in said temporary storing means, means for moving said storing means parallel to said conveyor to synchronize said storing means with said conveyor, and means for releasing the separating element from the storing means to allow it to drop between the groups of articles.

References Cited

UNITED STATES PATENTS

2,790,536 4/1957 Reed ----- 198—35

EDWARD A. SROKA, Primary Examiner

U.S. Cl. X.R.

198—35