

[54] ARTICLE PACKAGING MACHINE

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[51] Int. Cl. **B65b 5/10, B65b 39/00**

[58] Field of Search **53/184, 244, 246, 53/248; 221/11, 93, 124, 175, 185, 186, 289, 296, 298, 311**

[56] References Cited

UNITED STATES PATENTS

2,619,869	12/1952	Steward	53/246 X
2,718,342	9/1955	Anderson	53/246
2,828,888	4/1958	Nicolle	53/246 X
3,135,225	6/1964	Winkler et al.	221/186 X

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[57] ABSTRACT

The present article packaging machine is particularly suitable for use in depositing capsules into rows of

pockets formed in a web. As the web pockets are formed by separate apparatus, the web is periodically advanced a predetermined distance. The packaging machine includes a depositer which oscillates over the web pockets, the depositer moving forward with the advancing web. Shortly after the web movement stops, the depositer reaches the end of its forward stroke where the first capsules are discharged. Remaining capsules are sequentially discharged during the return stroke, the capsules being arranged in columns in vertically arranged passageways formed in the depositer. A plurality of vertically arranged pin gates in each passageway hold the capsules therein until the depositer reaches the proper discharge zone. When the depositer reaches the end of its rearward stroke, a top pin gate opens and a bottom gate closes in each of the passageways. This allows a column of capsules to drop within each of the passageways, and be held therein by the bottom gate. The depositer is thus ready to repeat the cycle when the web is once again advanced. A stationary transition member is mounted between the depositer and web, this member having a plurality of openings extending therethrough which openings are located over the web pockets to be filled; because the openings are suitably shaped, this member accepts the discharged capsules so as to allow them to clear the moving depositer, and at the same time guides the discharged capsules into the web pockets.

10 Claims, 7 Drawing Figures

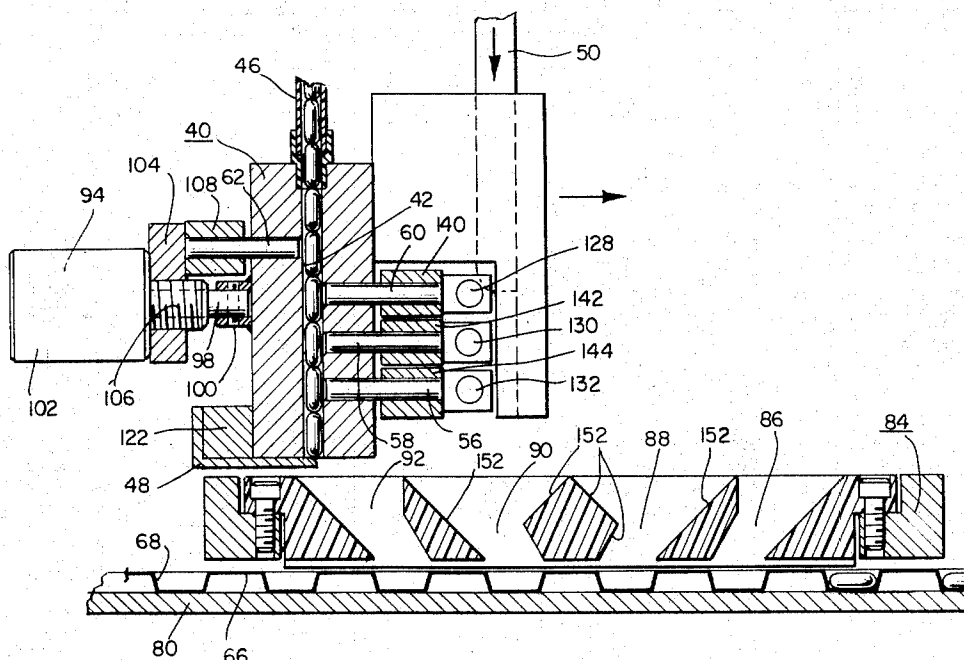


Fig. 2

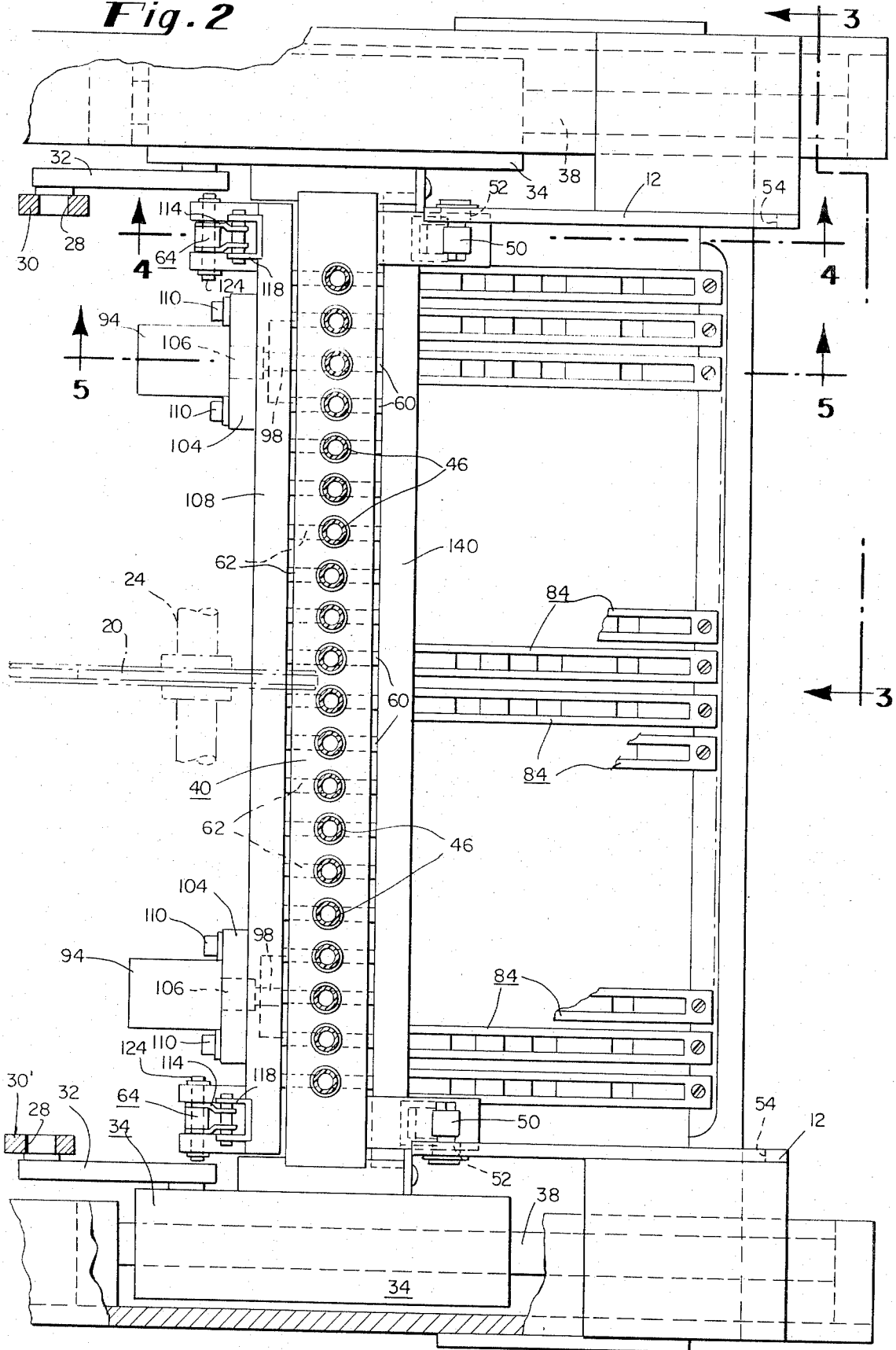


Fig. 3

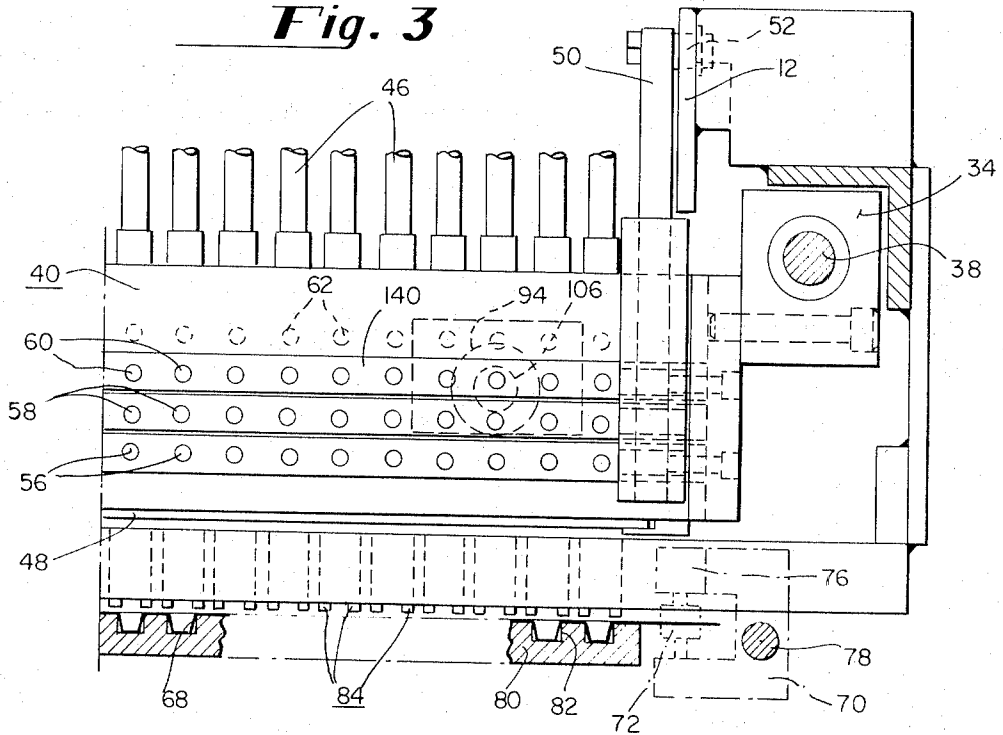
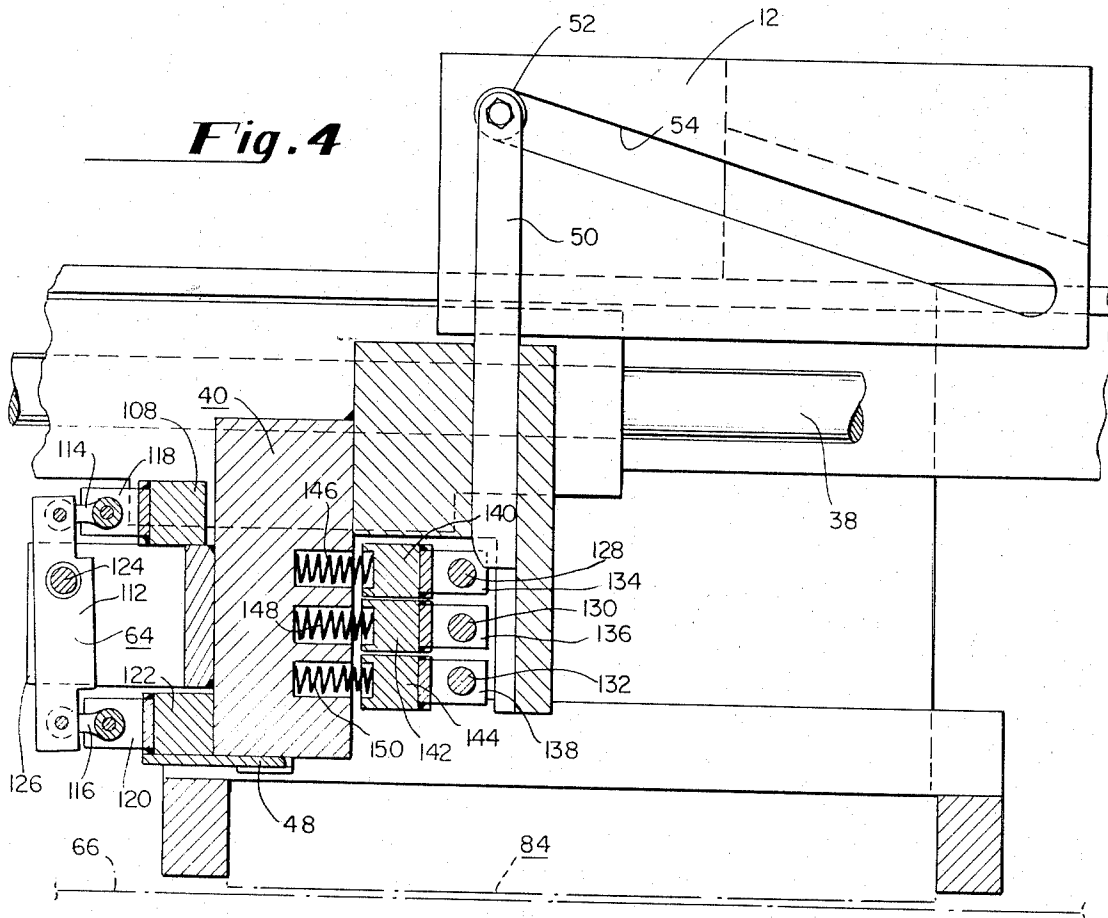
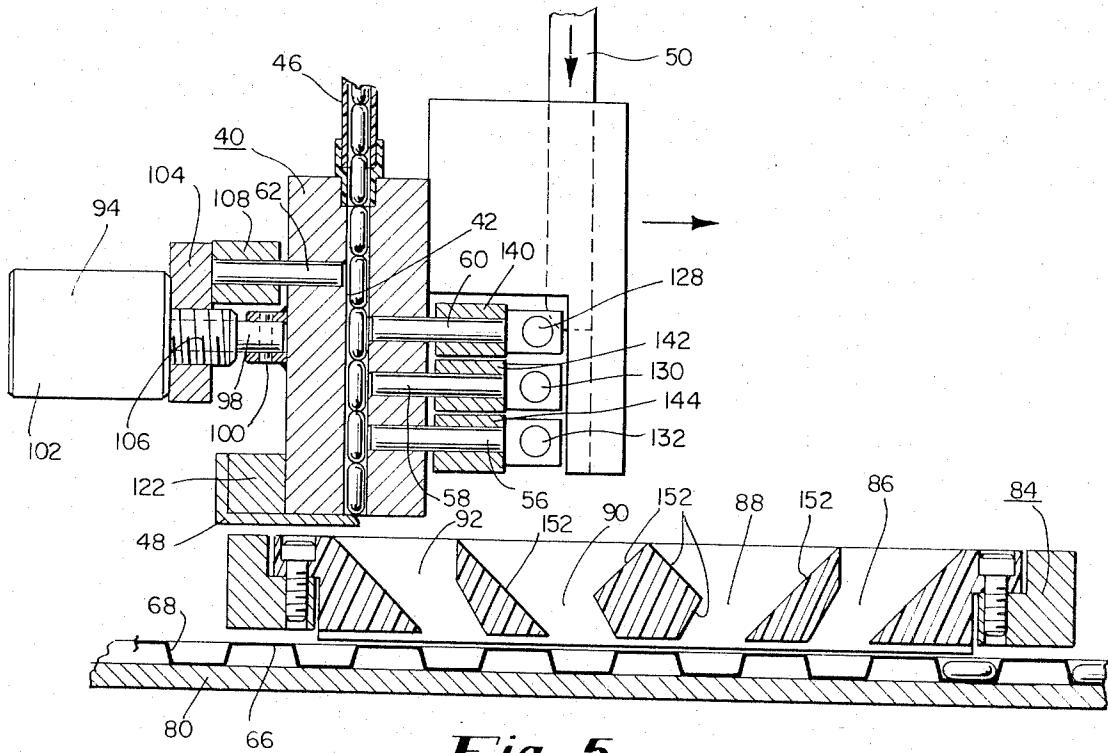
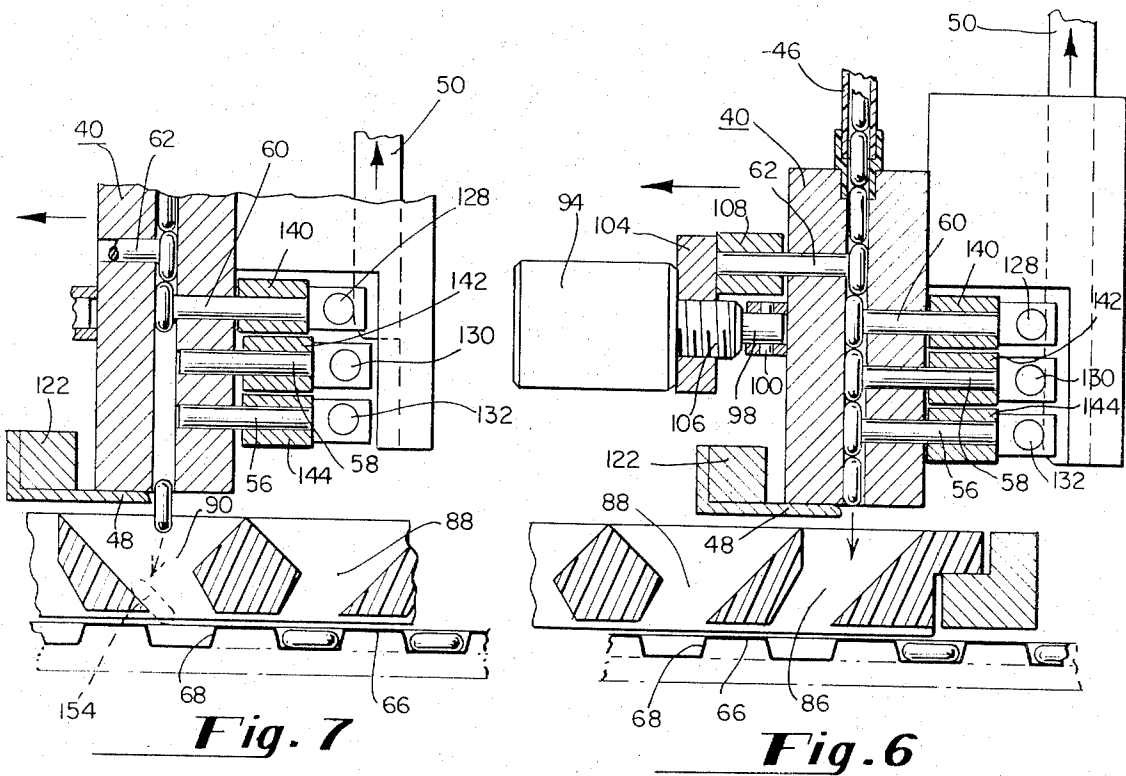


Fig. 4





ARTICLE PACKAGING MACHINE

BACKGROUND OF THE INVENTION

This invention relates in general to an article packaging machine for receiving and holding a plurality of articles, and subsequently depositing or discharging each of the articles at a predetermined location.

One example of where such a machine can be utilized is in filling a "web" with articles such as tablets or capsules, this web commonly being a sheet of plastic material having a plurality of pockets (receptacles) formed therein, each pocket being sized to receive one or more of such articles. The receptacles which are to receive the articles, however, need not be necessarily in the form of such web pockets; they might also be bottles or other types of containers capable of receiving one or more of such articles. After each receptacle is filled, it is generally closed at a subsequent station to complete the packaging operation.

The problems encountered with present machinery relate to the speed of operation, reliability and/or the complexities of the machinery. As the speed of operation is increased, the reliability of the machine sometimes decreases; also, because of the increased speed of operation of the machinery, there is a greater likelihood that the machinery will not discharge the articles at the proper time or place, or that it will not discharge the articles at all. To provide for more accurate and positive discharge of the articles, more complex machinery has been developed; this machinery requires a larger number of moving parts, is generally larger in size, and because of the increased complexity, increases the maintenance problems.

Thus, what is required, is a relatively simple and compact machine, which is capable of accurately and rapidly picking up and holding a plurality of articles from a source such as a manifold, and depositing or discharging these articles into one or more receptacles or containers. Since a typical environment in which such a machine might be utilized is that of depositing tablets, pills, or capsules, into a web, this is the environment which will be used in discussing the operation of the present invention, a web forming apparatus being used in conjunction with the invention; the invention, however, is not so limited.

SUMMARY OF THE INVENTION

The present invention relates to an article packaging machine which utilizes a depositer for depositing capsules into a web, the latter reciprocating or oscillating back and forth over the web in a substantially horizontal plane during the operation of the machine to receive, hold, and discharge a plurality of capsules, which discharged capsules are subsequently guided into the pockets of the web by a guide member.

The depositer has a plurality of vertically arranged and transversely spaced passageways extending therethrough, these passageways being designed to receive and hold a pre-determined number of capsules formed in a column. Initially, the capsules drop from a conventional tablet counter into an aligning manifold; such a counter is presently manufactured by the Merrill Division of Pennwalt Corporation in Chicago, Illinois. The aligning manifold utilizes a revolving shaft to upend the capsules, to arrange them into a plurality of columns, and to help them enter a plurality of vertically arranged hollow flexible members or tubes. The lower ends of

these tubes are connected to the upper ends of the passageways in the depositer, there being one tube connected to each of these passageways. A pre-determined level of capsules is maintained in each tube by a sensor that starts and stops the tablet counter; consequently, a supply of capsules is always available in the tubes for receipt by the depositer. Because the tubes are flexible, the lower ends of the tubes will move in a reciprocating or oscillating manner with the depositer during the operation of the machine.

A plurality of bottom pin gates holds the columns of capsules in the passageways of the depositer until reaching the proper discharge zone, there being one bottom pin gate for each passageway.

The present embodiment is designed to fill a web having 20 rows of pockets. During each cycle of operation of the machine, 4 capsules are discharged and deposited in each of the 20 rows. Since there are 20 rows of pockets, there are 20 passageways, there being one passageway over each of the rows.

A top pin gate for each of the passageways controls the capsules coming into the depositer, and clamps the fifth capsule from the bottom of the depositer in its associated passageway during the discharge stroke of the depositer. The bottom and top pin gates for each passageway are mounted on a toggle so that when one is open, the other is closed and vice versa.

There are three intermediate pin gates for each of the passageways, these intermediate pin gates being located between the bottom and top pin gates. These intermediate pin gates clamp the 2nd, 3rd, and 4th capsules respectively in each of the passageways until sequentially released during the discharge stroke of the depositer. Thus, during each discharge stroke of the depositer, 80 capsules are discharged and deposited in the web pockets.

As the depositer begins moving forward during operation of the machine, the bottom pin gates are closed, and the intermediate and top pin gates are all open; consequently, a column of capsules has dropped within each of the passageways of the depositer. Subsequently, during this forward stroke of the depositer, a cam finger closes the intermediate pin gates to clamp the second, third, and fourth capsules in passageways. As the depositer reaches the proper discharge zone at the end of its forward stroke, the bottom pin gates open, and the top pin gates close, thus discharging the first capsule from each passageway, and clamping the fifth capsule in each passageway.

As the bottom (first) capsule is discharged from each passageway and the depositer begins its rearward stroke, the finger cam sequentially moves out of driving contact with each of the intermediate pin gates in each passageway, thus allowing a spring to sequentially open each of the pin gates to sequentially discharge the second, third and fourth capsules therefrom. When the depositer reaches the end of its rearward stroke, the bottom pin gates close, thus opening the top pin gates to allow four more capsules to enter each passageway of the depositer. The depositer is now ready to repeat the cycle.

As stated above, although not so limited, the present article packaging machine is described herein in conjunction with a web forming apparatus. As the web pockets are formed, the latter mentioned apparatus will advance the web, and as the web moves forward, the article packaging machine receives a signal, and conse-

quently the depositer begins to move forward with the web. The web will advance a predetermined distance, and stop shortly before the depositer reaches the end of its forward stroke. As the depositer reaches the proper discharge zone at or near the end of its forward stroke, it will then begin to discharge the capsules, four capsules being discharge by the time the depositer reaches the end of its rearward stroke as described above. A transition member is stationarily disposed between the depositer and the web to assist in accurately guiding the discharged capsules into the web pockets. This transition member has a plurality of openings extending therethrough, each opening being adapted to receive one capsule and there being one opening associated with each web pocket. Each of these openings is larger at the top than at the bottom thereof, in order to easily receive the discharged capsule, and each opening is formed so as to allow the entire discharged capsule to clear the moving depositer while being guided into a web pocket by the transition member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view showing an article packaging machine in accordance with the present invention.

FIG. 2 is a top view taken through line 2—2 of FIG. 1, showing the top of the depositer, and the transition members used for guiding the discharged articles into the web pockets.

FIG. 3 is a cross-sectional view taken through line 3—3 of FIG. 2, showing the front of the depositer with the web located beneath it.

FIG. 4 is a cross-sectional view taken through line 4—4 of FIG. 2, showing the means for sequentially moving each of the pin gates.

FIGS. 5, 6, and 7 are sequential views showing various positions of the depositer during the operation of the machine.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 to 3, article packaging machine 10 is shown, which includes a stationarily mounted frame 12. Mounted to the latter is motor 14 utilized for driving sprocket 16. As sprocket 16 rotates in a counterclockwise direction, chain 18 moves likewise, thus driving larger sprocket 20 in a counterclockwise direction. Rotation of sprocket 20 causes crank 22 which is fixably connected to shaft 24 on which the latter sprocket is mounted, to rotate in a counterclockwise direction; this causes follower 26 to ride in slot 28 of crank 30, the latter being pivotally mounted to frame 12. Consequently, crank 30 rotates in a counterclockwise direction, moving carriage 34 via crank 32 in a forward direction as indicated by the solid arrow 36. As can be seen, this crank mechanism causes carriage 34 to reciprocate or oscillate in a substantially horizontal plane, the carriage being supported and guided by guide rods 38.

Fixedly mounted to carriage 34 is a depositer 40, the depositer containing a plurality of vertically arranged passageways 42 extending therethrough. As stated above, each of these passageways is designed to accept a predetermined number of capsules formed in a column. The capsules enter passageways 42 via manifold means 44, the latter including a plurality of vertically arranged elongated hollow flexible members or tubes 46, these tubes being connected to the upper ends of

passageways 42. Because the tubes are flexible, as carriage 34, and consequently depositer 40 reciprocate or oscillate back and forth on guide rods 38, the tubes 46 will move therewith as indicated by the phantom line position shown in FIG. 1.

As depositer 40 moves forward, a predetermined number of capsules (4 in the present instance) drop within each of the passageways 42, and are held therein by each of the bottom pin gates 48 until the bottom of each passageway 42 is located over the discharge zone where the first (bottom) capsule from each passageway is to be discharged; this discharge zone is located at or near the end of the forward stroke. As depositer 40 is moving forward, a cam finger 50 reciprocally mounted in the depositer moves downwardly as a result of its follower 52 riding in cam track 54 of frame 12 to sequentially move intermediate pin gates 56, 58 and 60 into clamp positions to respectively clamp the second, third, and fourth tablets within each of the passageways 42.

As shown in FIG. 1, depositer 40 is at the extreme end of its rearward stroke. In this position, top pin gates 62 in passageways 42 are open (i.e., in their release positions). Because top pin gates 62 are connected to the bottom pin gates 48 by toggle 64, when the top pin gates 62 are open, the bottom pin gates 48 are closed (i.e., in their clamp positions). Since intermediate pin gates 56, 58, and 60 are also open in this extreme rearward position, a column of four capsules drops within each passageway 42. When the bottom pin gates 48 are in their clamp positions, they hold the bottom capsules, and consequently the unclamped intermediate and top capsules within passageways 42.

The present article packaging machine is being described in conjunction with a web forming apparatus. In the present instance, this latter mentioned apparatus forms a web having 20 transversely spaced rows of pockets across the width thereof. As the pockets are formed, the web is periodically advanced or moved in the forward direction a predetermined distance.

Referring to FIGS. 1 and 3, web 66, having pockets 68 therein, is periodically advanced by means of a clamping mechanism 70, the latter having a lower clamp 72, and an upper clamp 74, the latter being operated by solenoid 76. Web 66 is disposed between clamps 72 and 74, and when it is time for the web to be advanced, solenoid 76 is automatically actuated to clamp the web within the mechanism 70. Mechanism 70 is fixedly connected to a movably mounted bar 78 which then advances a predetermined distance after which the solenoid is deactuated, and the bar returns to its initial rearward position ready to repeat the cycle. A support member 80 is stationarily mounted below the web, this support member having a plurality of grooves 82 formed therein. This support member with the grooves formed therein is designed to support and guide the web as it is being advanced. There is a clamping mechanism 70 located on each side of the web forming apparatus to simultaneously clamp each side of the web in order to advance the latter. Referring to FIG. 1, it can be seen that a transition member 84 is stationarily mounted between depositer 40 and web 66. This transition member has openings 86, 88, 90, and 92, extending therethrough. This transition member 84 is designed to assist in guiding the discharged capsules into the pockets 68 of the web 66, and will be more fully explained below.

After the pockets have been formed in the web, and the web is about to be advanced, a cam shaft in the web forming apparatus triggers a cycle initiating switch to actuate a clutch to begin the forward stroke of the depositer 40. There is a variable speed drive on the web forming apparatus, and article packaging machine 10, so that the web is always in an advanced position, and stops before depositer 40 reaches the end of its forward stroke. Depositer 40 reaches the end of its forward stroke, and begins its rearward stroke; the pin gates in the depositer will be sequentially released during the rearward stroke of the depositer so that the capsules are sequentially discharged over openings 86, 88, 90 and 92. After the cycle initiate switch is momentarily triggered to begin the forward stroke of depositer 40, the cycle hold switch continues to drive or energize the clutch power supply until such time as the depositer completes a cycle, and comes to rest in its rearward position. After reaching the extreme end of the rearward stroke, depositer 40 is locked into a detent position in which it remains until the cycle initiate switch is once again closed to repeat the cycle.

As stated above, when the depositer 40 is at the extreme end of its rearward stroke, the bottom pin gate 48 will be closed and the intermediate pin gates 56, 58, and 60, and the top pin gate 62 will be open in order that four more capsules can be dropped within each of the passageways 42. Referring to FIGS. 2, 4, and 5, it can be seen how this is accomplished. At the end of the rearward stroke of depositer 40, air is delivered to an air cylinder 94. This air cylinder is a conventional piston and cylinder arrangement, but having its piston rod 98 fixedly connected to depositer 40 by means of a pin 100. Consequently, if air is injected into air cylinder 94 cylinder casing 102 will move with respect to depositer 40. Casing 102, being threadably connected to plate 104 by means of a fitting 106, will thus move the latter mentioned plate with respect to depositer 40. A transverse bar 108 in which is mounted the top pin gate 62 for all 20 passageways 42 is secured to plate 104 by means of bolts 110 (see FIG. 2). Consequently, when air is delivered to air cylinder 94 so as to move casing 102 leftwardly as viewed in FIG. 5, all top pin gates 62 will move to their release positions. It should be noted that piston rod 98 must necessarily be slidably disposed within the fitting 106. Top pin gates 62 may be biased in one of their positions by suitable means, and moved to the other position by delivering air to the appropriate side of the piston within air cylinder 94. Other suitable means such as solenoids may be used to move top pin gates 62 from one position to the other.

Referring to FIG. 4, it can be seen that toggle 64 includes a central connecting member 112 which is pivotally connected to upper and lower connecting members 114 and 116 respectively. These latter connecting members are in turn pivotally connected to brackets 118 and 120 respectively, these latter mentioned brackets being fixedly connected to transverse bars 108 and 122 respectively. Lower transverse bar 122 has secured thereto 20 bottom pin gates associated with the 20 vertically arranged passageways 42 as described above. Thus, as can be seen in FIG. 4, as the top pin gates 62 are moved to their release positions, member 112 will rotate counterclockwise about shaft 124, the latter being mounted on a bracket 126 which is fixedly connected to the depositer 40. Thus, as the top pin gates 62 are moved to their release positions, bottom

pin gates 48 are moved to their clamp positions so as to close off the bottoms of passageways 42.

On each side of article packaging machine 10, a finger cam 50 is reciprocally mounted in depositer 40 so that when depositer 40 is moving in a forward direction, cam follower 52, riding in cam track 54, will act to drive finger cam 50 downwardly against rods 128, 130, and 132. These latter mentioned rods are mounted in brackets 134, 136, and 138, which in turn are fixedly secured to transverse bars 140, 142 and 144. The fourth, third, and second intermediate pin gates for each of the 20 passageways are secured within transverse bars 140, 142, and 144 respectively. Since each of these latter mentioned transverse bars is biased rightwardly as viewed in FIG. 4, it can be seen that each pin gate within each passageway is normally biased open, or in other words, is biased toward its release position. As can be seen, these bars are biased by springs 146, 148 and 150. Thus, as depositer 40 moves in the forward direction, or to the right as viewed in FIG. 4, finger cam 50 will be moved downwardly against each of the rods 128, 130, and 132. Consequently each of the intermediate pin gates within each of the passageways 42 will be moved to its clamp position before depositer 40 reaches the end of its forward stroke.

Referring to FIGS. 5 through 7, the operation of the article packaging machine will be briefly summarized. FIG. 5 illustrates the machine with the depositer at the extreme end of its rearward stroke. Top pin gate 62 is in its release position as are the intermediate pin gates 56, 58, and 60. The bottom pin gate 48 being closed, a column of capsules is thus held within depositer 40 ready for discharge.

It should be noted that each of the openings 86 through 92 of the transition member 84 is larger or longer at the top than at the bottom thereof. By making each of the openings later at the top, it presents a larger discharge zone over which depositer 40 may discharge the capsules during its reciprocating or oscillating movements. It should also be noted that each of these openings is at least partially defined by various inclined surfaces 152. By designing the transition member 84 in this manner, each of the capsules may be discharged over a wider or longer discharge zone than would be the case if the capsules had to be deposited directly into the web pockets 68. Each of the openings 86 through 92 are formed so as to allow the entire capsule to clear the moving depositer after being discharged from passageway 42 so that the capsule will not be crushed while being guided into a web pocket; the incline surfaces 152 assist in orienting each capsule, and guiding it into a web pocket. It is noted that the bottoms of each of the openings 86 through 92 are located precisely above web pockets 68. The width of each of the openings 86 through 92 as measured in a direction transverse to that of the movement of depositer 40 will naturally be less than the length of each capsule. Thus, because of this, and because of the inclined surfaces 152, each of the discharged capsules will have plenty of time to clear the depositer 40 upon being discharged, and properly align itself for movement into a web pocket 68.

At the proper time, depositer 40 will begin its forward stroke, moving to the right as viewed in FIG. 5. Upon reaching the discharge zone presented by the top of openings 86 (FIG. 6), a signal is generated, and air is injected into air cylinder 94 to move top pin gate 62

to its clamp position, thus clamping the fifth capsule in place within passageway 42; simultaneously, bottom pin gate 48 is moved to its release position, thus discharging the first (bottom) capsule in the column. As stated above, intermediate pin gates 56, 58, and 60 are closed (moved to their clamp position) during the forward stroke of depositer 40, thus respectively clamping the second, third, and fourth capsules in place.

As depositer 40 begins its rearward stroke, finger cam 50 moves upwardly out of depositer 40, thus sequentially releasing intermediate pin gates 56 and 58, until reaching the position shown in FIG. 7. In FIG. 7, the third capsule is leaving or being discharged from the bottom of passageway 42, and as depositer 40 continues to move leftwardly, the capsule will eventually be deposited in a position substantially as shown by dotted line position 154. Depositer 40 will continue to move leftwardly, thus releasing intermediate pin gate 60 to discharge the fourth capsule over the discharge zone presented by the top of opening 92. Upon reaching the extreme end of its rearward stroke, depositer 40 will come to rest in a detent position, and will remain therein until receiving a subsequent signal to repeat the cycle. Upon reaching the extreme end of its rearward stroke, article packaging machine 10 will receive a signal to allow casing 102 to move leftwardly as viewed in FIG. 5 to move top pin gates 62 back into their release positions. Consequently, bottom pin gates 48 will move to their clamp positions as shown in FIG. 5, and 4 capsules drop within passageway 42. Depositer 40 is now ready to move forward once again upon receiving the appropriate signal.

I claim:

1. An article packaging machine for receiving and holding a predetermined number of articles formed in a column, and sequentially discharging said articles into a web having a row of pockets formed therein, said machine comprising a depositer mounted for cycles of oscillating movement over said web in the direction of said row in a substantially horizontal plane, said depositer having a vertically arranged passageway extending from the upper to the lower surface of said depositer for containing said column of articles, top clamping means mounted for movement into alternate clamp and release positions for alternately clamping and releasing the top article of said column in said passageway, intermediate clamping means mounted for movement into alternate clamp and release positions for alternately clamping and releasing an intermediate article in said column, means for moving said intermediate clamping means into said clamp and release positions, bottom clamping means mounted for movement into alternate clamp and release positions for alternately holding and releasing the bottom article of said column, and means for moving said top clamping means into one of said positions while simultaneously moving said bottom clamping means into the other of said positions and vice versa, and means for sequentially first moving said bottom clamping means, then moving said intermediate clamping means, and finally moving said top clamping means each into said release positions during one portion of each of said cycles.

2. An article packaging machine according to claim 1 including manifold means disposed above said depos-

iter, and adapted to release articles to said passageway.

3. An article packaging machine according to claim 2 wherein said means for simultaneously moving said top and bottom clamping means to opposite clamp and release positions, includes a connecting member, said connecting member being pivotally connected to said top and bottom clamping means, and being mounted so as to pivot about a point located between said top and bottom clamping means.

4. An article packaging machine according to claim 3, wherein said means for moving said intermediate clamping means into said clamp and release positions includes cam means.

5. An article packaging machine according to claim 4, wherein said cam means includes stationarily mounted frame means having a cam track formed therein, and a cam finger adapted to reciprocate within said depositer, said cam finger being adapted to move into and out of said depositer during said oscillating movement to alternately move said intermediate clamping means into said clamp and release positions.

6. An article packaging machine according to claim 4, and further including means stationarily mounted between said depositer and said web for allowing said articles being sequentially discharged from said depositer to clear the depositer while being simultaneously guided into said pockets.

7. An article packaging machine according to claim 6 wherein said latter mentioned means comprises a transition member having plurality of openings extending from the upper to the lower surface thereof, said openings being formed in a row and disposed in line with said row of pockets, the upper end of each of said openings being larger than the lower end thereof, the lower ends of said openings being located directly above said pockets, said openings being formed so as to allow the entire discharged articles to clear said depositer, whereby said articles sequentially discharged from said depositer are easily accepted by said guide means, and guided into their respective pockets.

8. An article packaging machine according to claim 6 wherein said manifold means includes a vertically arranged elongated hollow flexible member, the lower end of said flexible member being connected to the upper end of said passageway, and adapted to contain a supply of said articles for release into said depositer.

9. An article packaging machine according to claim 5 wherein said depositer includes a plurality of said passageways transversely spaced across the width thereof, each of said passageways having said top clamping means, said bottom clamping means, and said intermediate clamping means, and means connecting each of said clamping means in each passageway with the corresponding clamping means in the remaining passageways whereby said means for sequentially moving said clamping means into their alternate positions simultaneously moves all of the corresponding clamping means.

10. An article packaging machine according to claim 9, and further including an air cylinder for moving said top and bottom clamping means, the piston rod of said air cylinder being fixedly connected to said depositer.

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