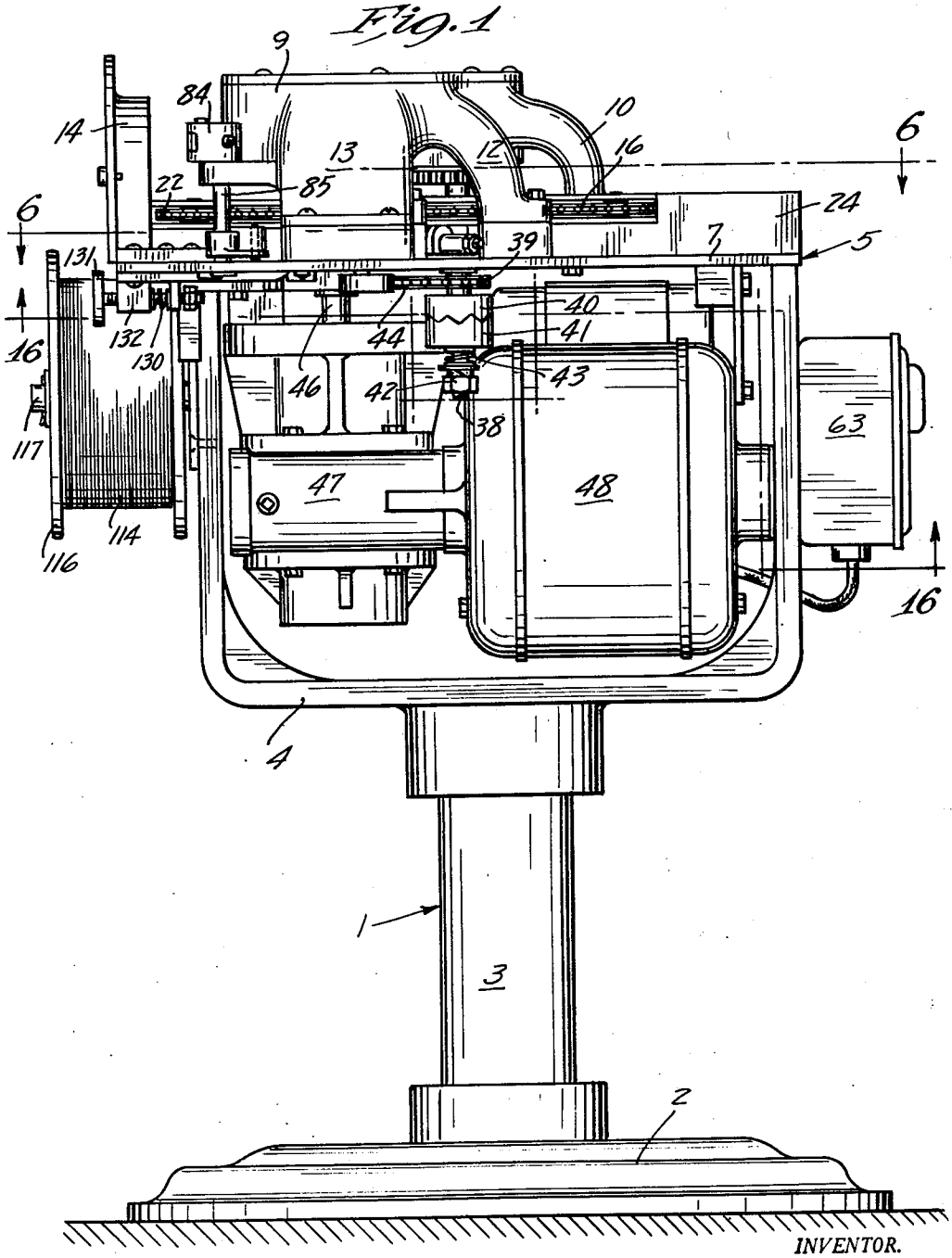
Oct. 29, 1957 E. E. RANTA 2,810,996

PACKAGE CLOSING MACHINE

Filed April 22, 1954 7 Sheets-Sheet 1

Fig. 1



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PACKAGE CLOSING MACHINE

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Fig. 2

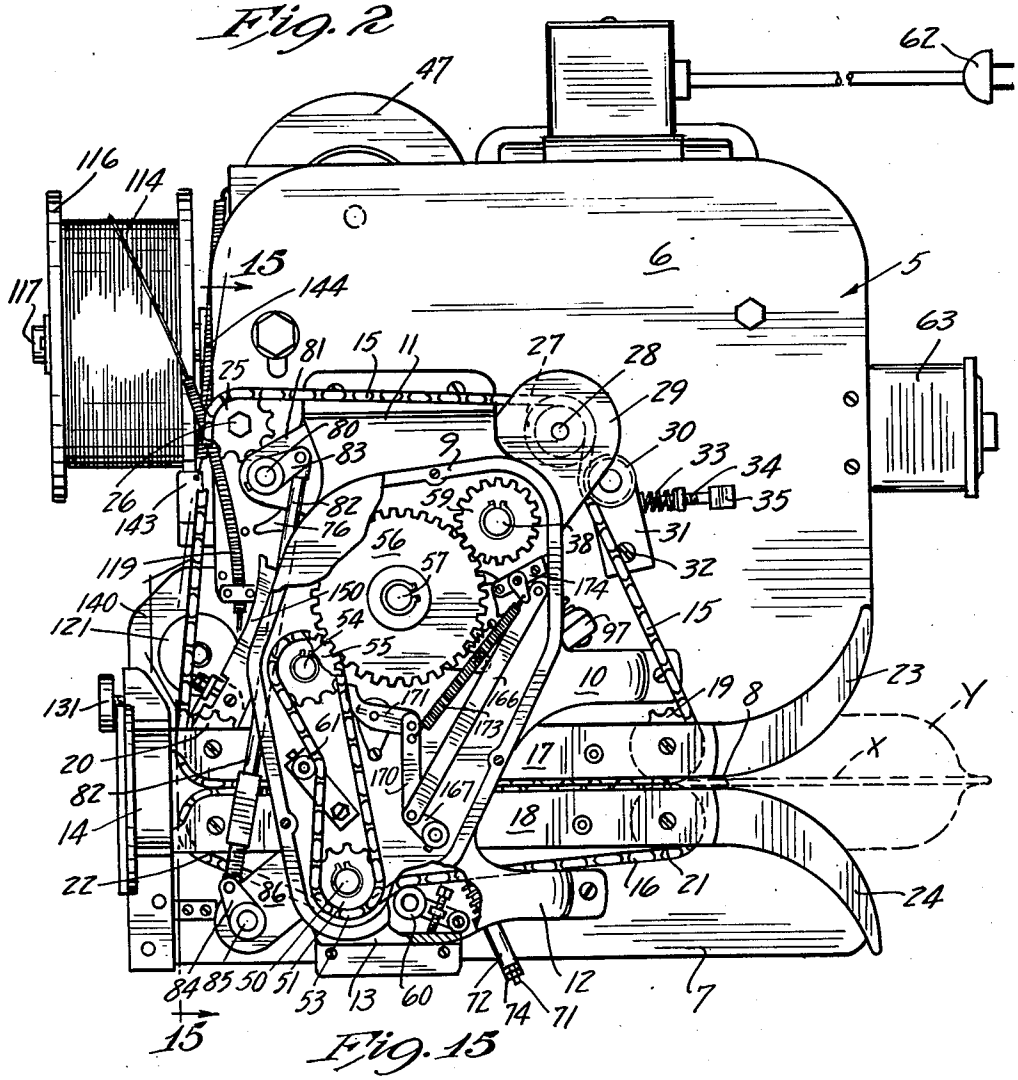
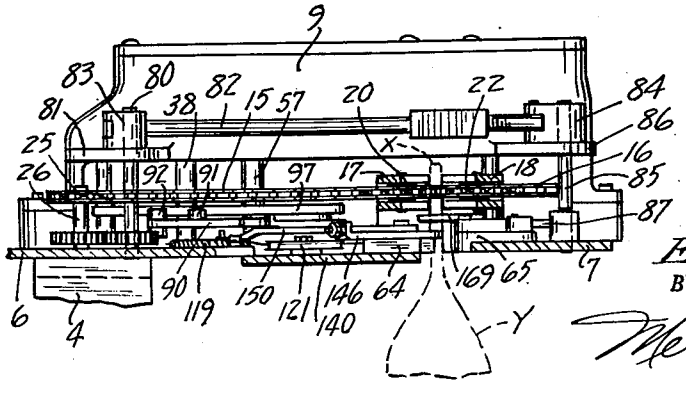


Fig. 15



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Fig. 3

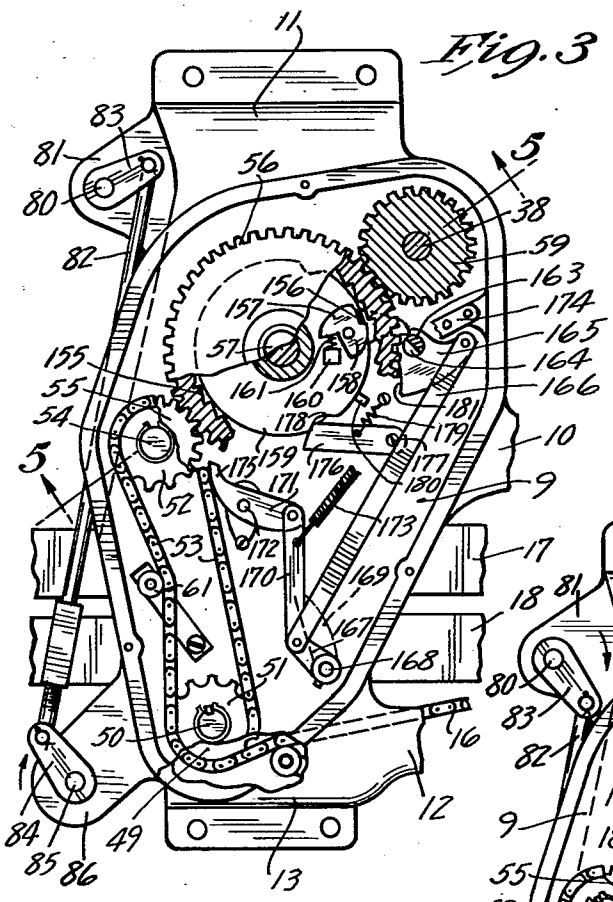


Fig. 4

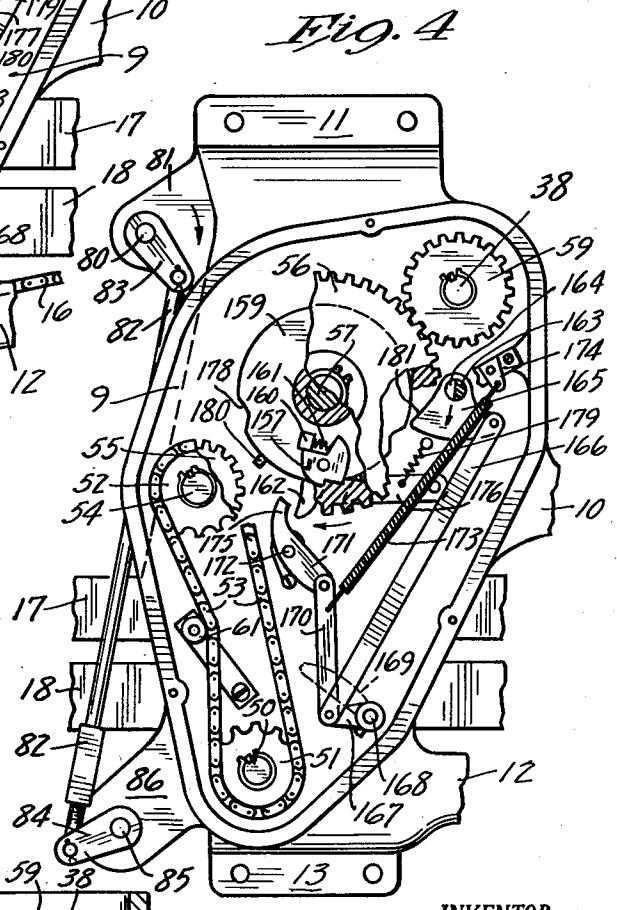
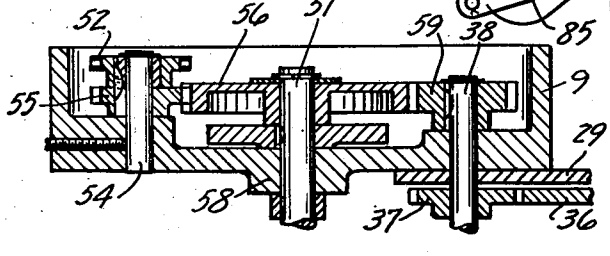


Fig. 5



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PACKAGE CLOSING MACHINE

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Fig. 6

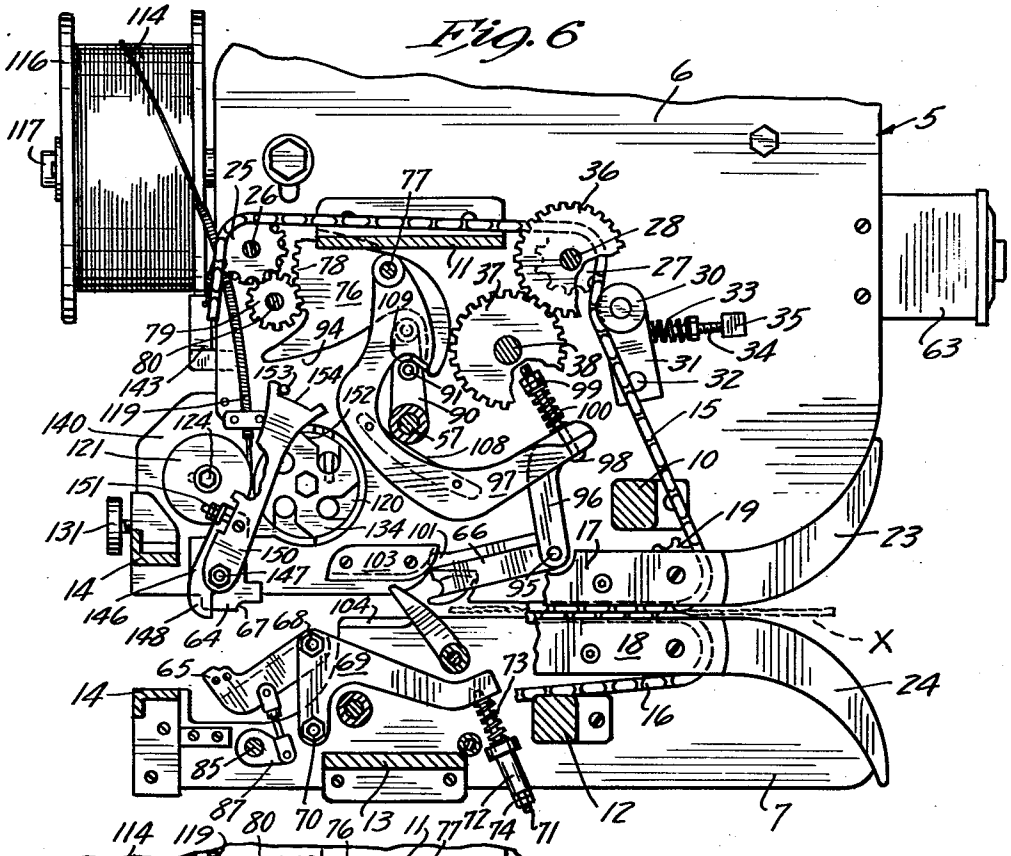
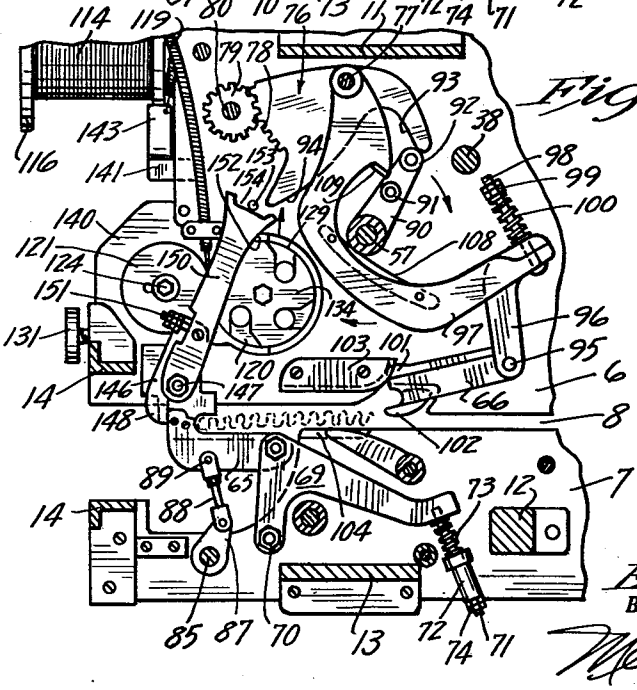


Fig. 7



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PACKAGE CLOSING MACHINE

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Fig. 8

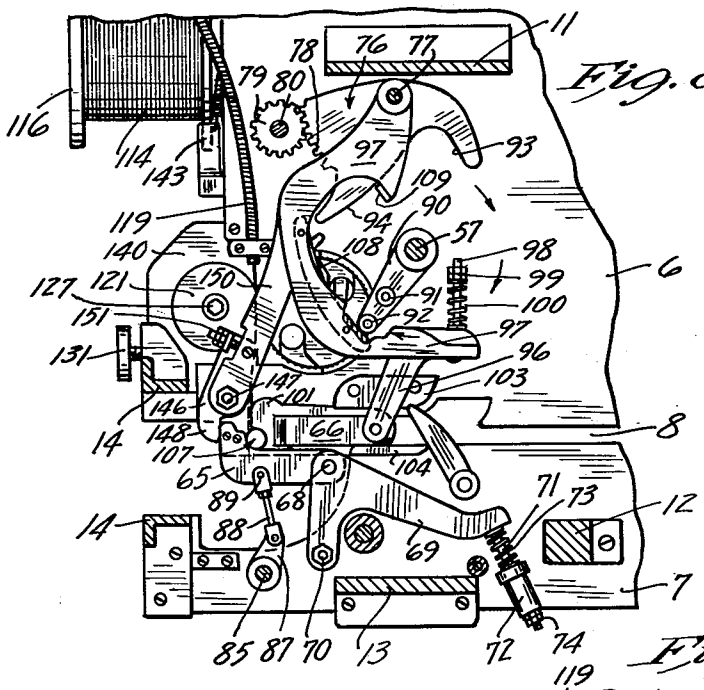


Fig. 9

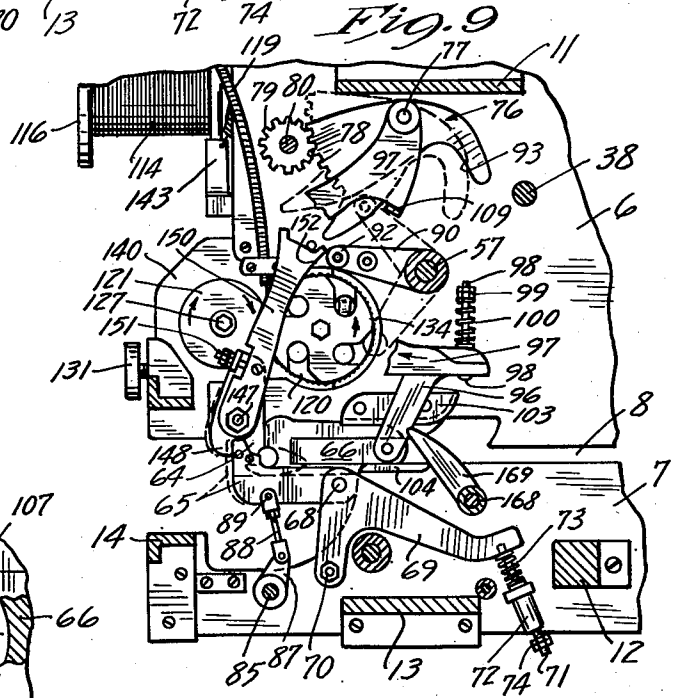
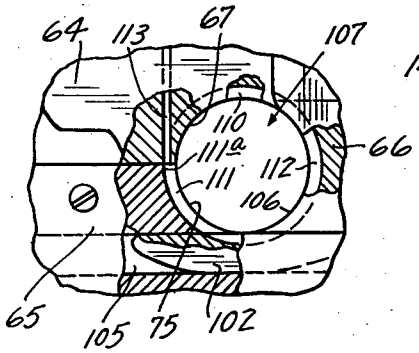


Fig. 14

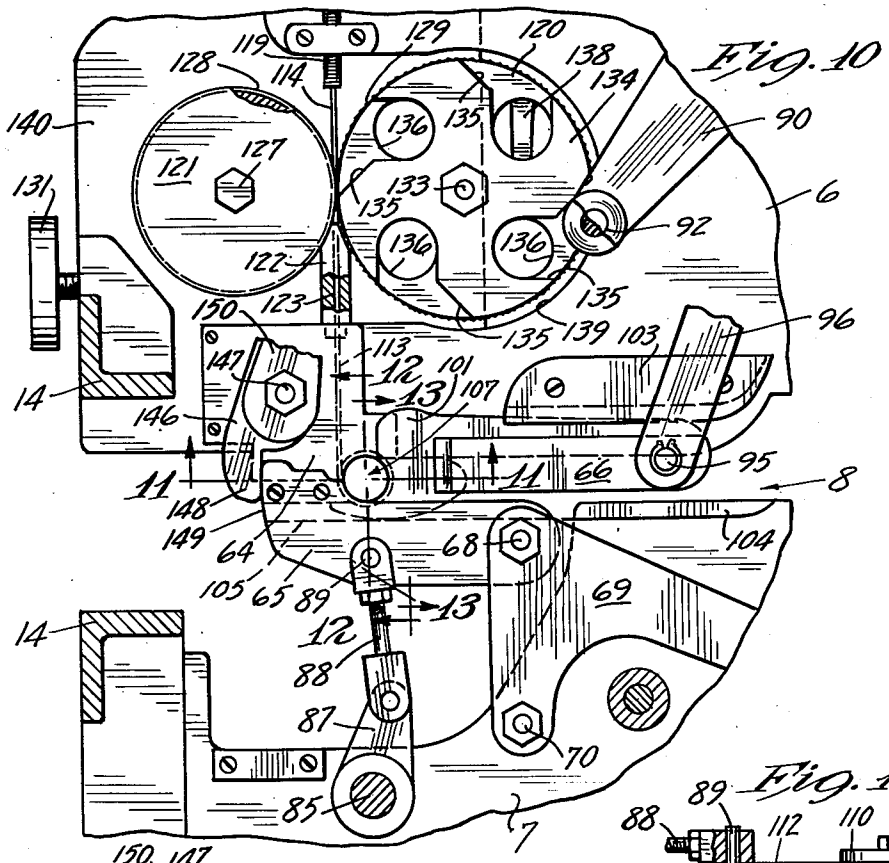


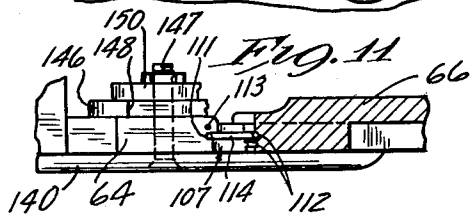
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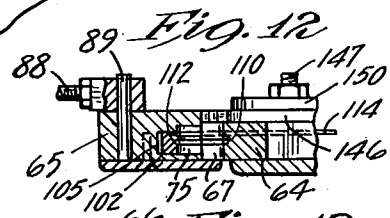
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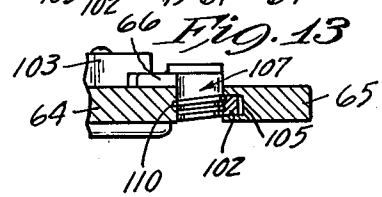
PACKAGE CLOSING MACHINE

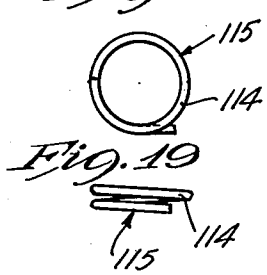
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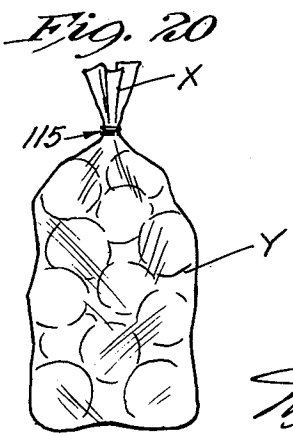












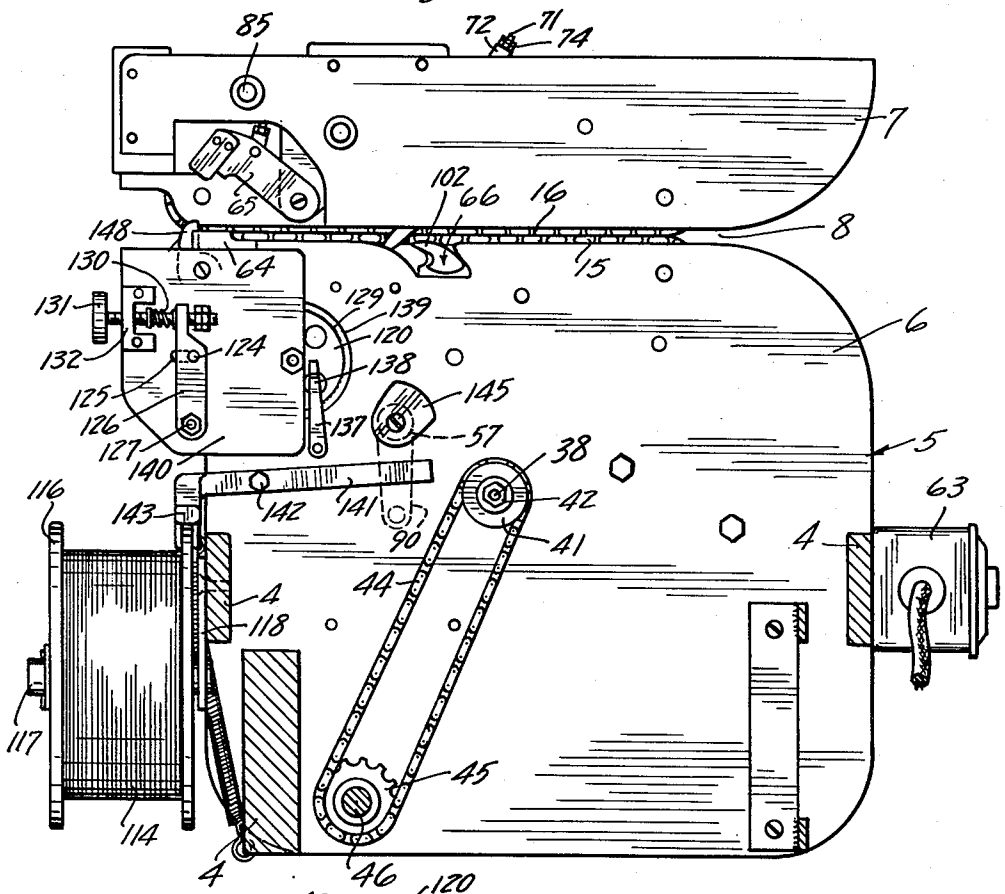
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PACKAGE CLOSING MACHINE

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Fig. 16



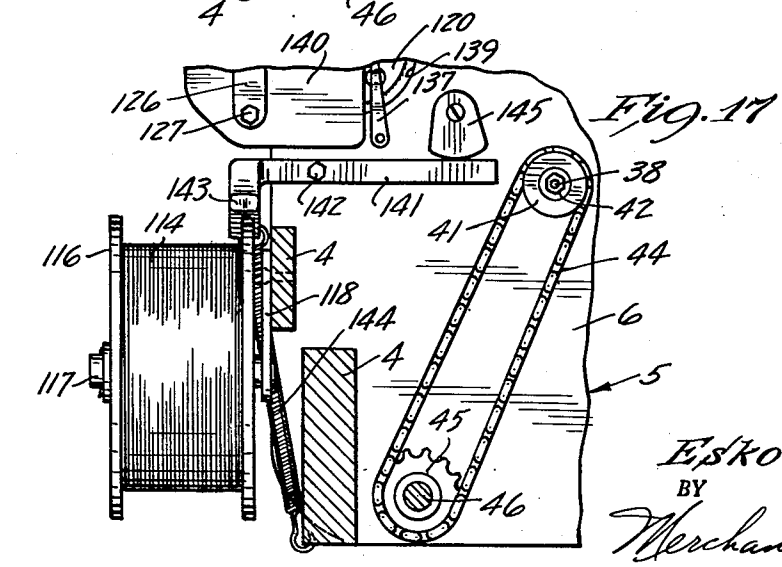


Fig. 17

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United States Patent Office 2,810,996 Patented Oct. 29, 1957

2,810,996

PACKAGE CLOSING MACHINE

Esko E. Ranta, St. Louis Park, Minn.

Application April 22, 1954, Serial No. 424,811

7 Claims. (Cl. 53—71)

My invention relates generally to machines for closing filled packages, wrappings and the like, and more particularly to package closing machines which gather closed the open ends of filled packages and which tie the same in gathered closed condition.

Still more specifically, my invention is in the nature of a machine for closing packages of the above type made from relatively soft pliable material such as sheet polyethylene, cloth fabric and the like.

Heretofore the packages, after having been filled to a predetermined level or extent with bulk merchandise, such as vegetables, fruit and the like, have been gathered and tied closed by hand, or the packages have been stitched closed by relatively expensive and cumbersome sewing machines. Hand tying of packages such as bags or wrappings is a relatively slow and expensive operation particularly in view of the present high labor costs.

An important object of my invention is the provision of a relatively small light weight machine which can be easily transported from place-to-place, and which may be set on a bench or table close to the area of the bag filling operation, whereby the packages may be closed immediately after filling, and without resorting to the use of a special conveyor mechanism.

Another object of my invention is the provision of a machine of the type set forth which will automatically gather and tie the open end of a filled package without injury to the package or the contents thereof and in a minimum of time.

Another object of my invention is the provision of a gathering and tying machine which utilizes a minimum of material to tie the package closure and hold the same closed until it is desired to open the bag.

Still another object of my invention is the provision of a machine as set forth which is highly efficient in operation and which is rugged in construction and durable in use.

The above and still further highly important objects and advantages of my invention will become apparent from the following detailed specification, appended claims and attached drawings.

Referring to the drawings, which illustrate the invention, and in which like characters indicate like parts throughout the several views:

Fig. 1 is a view in side elevation of a bag top gathering and tying machine built in accordance with my invention;

Fig. 2 is a view in plan of the machine of Fig. 1, some parts being broken away;

Fig. 3 is a fragmentary detail corresponding to a portion of Fig. 2 but showing a different position of some of the parts, some parts being broken away and some parts shown in section;

Fig. 4 is a view corresponding substantially to Fig. 3 but showing a still different position of some of the parts;

Fig. 5 is a fragmentary section taken substantially on the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary view partly in plan and partly in horizontal section taken substantially on the irregular line 6—6 of Fig. 1, the parts thereof positioned as at the beginning of an operational cycle;

Fig. 7 is a fragmentary view corresponding to a portion of Fig. 6 but showing some of the parts thereof in a position assumed during the initial step of the operational cycle of the machine;

Fig. 8 is a view corresponding to Fig. 7 but showing the parts thereof in a position assumed during the top gathering and tying position of the machine;

Fig. 9 is a view corresponding to Fig. 7 but showing the parts thereof in a tie wire severing position;

Fig. 10 is a greatly enlarged fragmentary view in plan corresponding to a portion of Fig. 8;

Fig. 11 is a fragmentary section taken on the line 11—11 of Fig. 10;

Fig. 12 is a fragmentary section taken substantially on the line 12—12 of Fig. 10;

Fig. 13 is a fragmentary section taken substantially on the line 13—13 of Fig. 10, the line 13—13 being coincident with the line 12—12 of Fig. 10;

Fig. 14 is a greatly enlarged fragmentary view in plan corresponding to a portion of Fig. 10, some parts being broken away and some parts shown in section and illustrating the guide channel for the tie wire of my invention;

Fig. 15 is a transverse section taken substantially on the line 15—15 of Fig. 2;

Fig. 16 is a view partly in bottom plan and partly in horizontal section taken substantially on the irregular line 16—16 of Fig. 1;

Fig. 17 is a view corresponding to a portion of Fig. 16 but showing a different position of some of the parts;

Fig. 18 is a view in plan of a length of tie wire formed in a manner to close a bag in accordance with my invention;

Fig. 19 is a view in side elevation of the tie wire of Fig. 18; and

Fig. 20 is a view in side elevation of a bag gathered and tied by the machine of my invention.

In the preferred embodiment of the invention illustrated the numeral 1 indicates in its entirety a supporting structure comprising a base plate 2, an upstanding column 3 and a generally U-shaped frame 4. The column 3 projects upwardly from the central portion of the base 2 and the frame 4 is rigidly secured to the upper end of the column 3. Mounted on the upper end of the frame 4 is a horizontally disposed relatively flat plate-like table 5 comprising a pair of table top sections 6 and 7 which define therebetween a channel or passage 8 which is adapted to receive the upper end portion X of a filled bag Y. The table section 7 lies in the same plane as the table section 6 and is supported therefrom by a transmission housing 9 that is mounted in upwardly spaced relation to the table section 6. The housing 9 has legs 10 and 11 which are bolted or otherwise rigidly secured to the table section 6 and other legs 12 and 13 that are bolted or otherwise rigidly secured to the table section 7. At the delivery end of the channel 8, the table sections 6 and 7 are rigidly secured together by an inverted generally U-shaped bridge member 14.

Means for supporting and transporting filled bags Y through the machine comprises a pair of endless belts in the nature of link chains 15 and 16 which have longitudinally extended outer peripheral surface portions in face-to-face engagement within the passage 8. Said passage 8 is further defined by guide channels 17 and 18 mounted on the adjacent edges of the table sections 6 and 7 respectively. The endless chain 15 runs over a pair of sprocket wheels 19 and 20 that are journalled in opposite end portions of the guide channel 17 whereas the link chain 16 runs over a pair of sprocket wheels

21 and 22 that are journalled in opposite end portions of the guide channel 18. The guide channels 17 and 18 together with their respective sprocket wheels are so disposed with respect to each other that, when the upper end portion X of a bag Y is manually fed thereto, the upper end portion X will be gripped and firmly held between the engaging outer surface portions of the chains 15 and 16. It will be noted by reference to Fig. 2 that the inlet ends of the guide channels 17 and 18 are curved laterally away from each other as indicated at 23 and 24 respectively to form guide rails or the like. The chain 15 runs over an idler sprocket 25 that is journalled on a stub shaft 26 suitably mounted on the table section 6, and over a drive sprocket 27 fast on a shaft 28 suitably journalled in the table section 6 and an overlying bearing 29. Preferably, and as shown in Fig. 2, the bearing 29 projects laterally outwardly from the transmission housing 9. A tensioning roller 30 is mounted for rotation on an arm 31 that is pivotally secured to the table section 6 as indicated at 32. A coil compression spring 33 is interposed between the arm 31 and one end of an adjustment stud 34 that is screw threaded into a nut-acting boss 35 extending upwardly from the table section 6, whereby to maintain a desired tension on the link chain 15. A spur gear 36 mounted fast on the shaft 28 has meshing engagement with a similar gear 37 fast on a drive shaft 38 that extends upwardly into the interior of the housing 9 where it is journalled at its upper end, and downwardly through a suitable bearing in the table section 6. With reference to Fig. 1 it will be seen that a sprocket wheel 39 is journalled on the shaft 38 below the table section 6 and is coupled for common rotation to a toothed clutch member 40 which cooperates with a second clutch member 41. This second clutch member 41 may be assumed to be splined or otherwise secured to the shaft 38 for common rotation therewith and for axial sliding movements with respect thereto. The lower end of the shaft 38 is threaded to receive an adjustment nut 42 between which and the adjacent clutch member 41 is interposed a coil compression spring 43 which yieldingly biases the clutch member 41 toward engagement with its cooperating clutch member 40. This clutch arrangement merely provides a safety device and of itself forms no part of the instant invention. Hence the same is not shown nor described in greater detail.

An endless drive chain 44 runs over the sprocket 39 and another sprocket 45 fast on a shaft 46 which comprises the output shaft of a speed reduction system not shown but contained within a housing 47 and which may be assumed to be driven from a motor 48 rigidly secured to the frame 4 below the table section 6.

The link chain 16 is driven from the shaft 38 by means now to be described. The chain 16 runs over a driving sprocket 49 that is keyed or otherwise rigidly secured to a vertically disposed shaft 50 that is journalled in the transmission housing 9. A second sprocket 51 is mounted fast on the shaft 50 within the housing 9 and has running thereover and another sprocket 52 a driving chain 53, see Figs. 2 to 5 inclusive. The sprocket wheel 52 is mounted on a stub shaft 54 for common rotation with a gear 55 that has meshing engagement with a relatively large gear 56 that is journalled on a shaft 57 which in turn is journalled in a bearing boss 58 in the bottom wall of the housing 9, see Fig. 5. The gear 56 has meshing engagement with another gear 59 that is keyed to the shaft 38 for common rotation therewith. The relative sizes between the several gears and sprockets in the above described train is such that the peripheral speed of the link chain 16 is equal to that of its cooperating chain 15. The chains 15 and 16 obviously are driven in directions to feed bags from the right to the left with respect to Figs. 1–4 and 6–10 inclusive and 16. With reference to Fig. 2 it will be seen that idler rollers 60 and 61 are utilized to maintain their respective chains 16 and 53 in a relatively taut condition. The motor 48 is adapted to be connected to a suitable source of electrical potential, such as a convenience outlet, not shown, through the medium of a conventional plug 62 and is controlled by a switch 63, whereby to impart continuous and uninterrupted feeding movement to the link chains 15 and 16.

Mechanism for gathering the upper end portion X of the bag Y into closed relationship above the central portion of the bag Y comprises a relatively stationary gathering element 64 and first and second movable elements 65 and 66 respectively, and mechanism for operating said movable elements. The stationary element 64 is bolted or otherwise anchored to the table section 6 adjacent the discharge end of the passage 8 therebetween and the table section 7, and has a portion projecting laterally into the path of travel of a bag through the passage 8. The stationary element 64 is formed to provide an arcuate portion 67 which is engaged by the bag top X during its movement through the machine. The first movable gathering element 65 extends generally longitudinally of the path of travel of the bag through the machine and is pivotally connected as at 68 to a generally L-shaped arm 69 for swinging movements transversely of the direction of movement of bags through the machine between an inoperative position in laterally spaced relation to the stationary element 64, as shown in Fig. 6, and an operative position in engagement with the stationary element 64 as shown in Figs. 7–10 inclusive. The arm 69 is pivotally mounted at one end to the table section 7 as indicated at 70 for relative swinging movements in a direction to impart movements to the movable element 65 in a direction longitudinally of the path of travel of the bags for a purpose which will hereinafter be described. At its other end, the arm 69 is provided with a stud or pin 71 which projects laterally through a tubular support 72 that is mounted on the table section 7. A coil compression spring 73 is interposed between the support 72 and the adjacent end of the arm 69 and yieldingly urges said arm in one direction of swinging movement thereof. An adjustment nut 74 is screw threaded onto the threaded outer end of the stud 71 and limits swinging movement of the arm 69 in the direction of yielding bias of the spring 73. The movable element 65 is formed to provide an arcuate portion 75 which forms a circumferential extension of the arcuate portion 67 when the element 65 is moved to its operative position in engagement with the stationary element 64, and cooperates therewith to stop movement of the bag through the machine.

Means for imparting movements to the movable element 65 toward and away from the stationary element 64 includes a cam 76 journalled on a stub shaft 77 which projects upwardly from the table section 6. The cam 76 is provided with a toothed segment portion 78 which has meshing engagement with a gear 79 fast on a shaft 80 that is journalled in the table section 6 and in a bearing bracket 81 integrally formed with the leg 11 of the housing 9. A pitman arm 82 has its opposite ends pivotally connected to the outer ends of a pair of crank arms 83 and 84, the former of which has its inner end keyed or otherwise rigidly secured to the upper end of the shaft 80, and the latter of which has its inner end keyed or otherwise secured to a rock shaft 85 which extends vertically through and is journalled in the table section 7 and in a bearing bracket 86 extending laterally outwardly from the transmission housing 9. Intermediate the table section 7 and the bearing 86, is a crank arm 87 having its inner end fast on the shaft 85 and its outer end pivotally connected to one end of a rigid link 88, the other end of which is pivotally secured to the first movable element 65 as indicated at 89. Mounted fast on the shaft 57 is a crank 90 having radially spaced axially extending inner and outer crank pins 91 and 92 respectively, the latter of which is adapted to successively engage spaced cam surface portions 93 and 94 on the cam 76, during a single cycle of operation of the machine. The shaft 57 ro-

tates in a clockwise direction with respect to Figs. 2–4 and 6–9 inclusive, and engagement of the crank pin 92 with the cam surface portion 93 causes movement of the element 65 toward its operative position in engagement with the stationary element 64. Then when the shaft 57 has rotated to a predetermined degree, the crank pin 92 engages the cam surface portion 94 of the cam 76 and causes the movable element 65 to be retracted to its inoperative position of Fig. 6.

The second movable gathering element 66 is in the nature of a shuttle pivotally connected at its rear end as indicated at 95 to one end of an arm 96 that is connected to one end of a cam 97 for limited independent movement with respect thereto. As shown, the outer end portions of the arm 96 and cam 97 are in face-to-face contact and are provided with aligned apertures through which extends a bolt 98 having adjusting and lock nuts 99 on the threaded end thereof. A coil compression spring 100 interposed between the nuts 99 and the outer end of the arm 96 yieldingly urges said arm 96 and cam 97 toward face-to-face relationship of their outer end portions. Thus, for the greater part of the operational cycle of the machine, the arm 96 and cam 97 operate as a single part. The cam 97 is journalled at its inner end to the shaft 77 in overlying relationship to the shaft 76, and swinging movement of the cam 97 and arm 96 imparts movement to the second movable element 66 between its inoperative position at one side of the passage 8 in spaced relation to the stationary element 64 longitudinally of the passage 8, and an operative position wherein the second movable element 66 engages both elements 64 and 65. The forward end of the element 66 is formed to provide a shoe 101 and a finger 102, the former of which rides in a guideway defined by a guide member 103 secured to the table section 6, and the latter of which is adapted to be guided in a longitudinally extended guideway 104 in the table section 7 and in a longitudinally extended groove 105 in the first movable element 65. The forward end of the element 66 together with the finger 102 is formed to provide an arcuate portion 106 which cooperates with the arcuate portions 67 and 75 of the elements 64 and 65 respectively to define a circular opening 107 through which the bag top portion X extends. Forward movement of the movable element 66 into the passage 8 and toward engagement with the elements 64 and 65 occurs immediately after passage of the bag top X beyond the forward end of the element 66 in its inoperative position. Thus, as will hereinafter become apparent, as soon as the bag top portion X has moved beyond the forward end of the element 66, said element 66 moves forwardly toward the elements 64 and 65 whereby to gather the bag top within the opening 107. As shown, the finger 102, riding in the slot 105 prevents the bag from catching in the guide track 104 and on the adjacent side of the movable element 65 during the gathering operation. The cam 97 is provided with a pair of cam surface portions 108 and 109, the former of which is engaged by the crank pin or roller 92 during rotation of the crank 90, and the latter of which is subsequently engaged by the crank pin or roller 91 in a single operational cycle of the machine. As indicated in Figs. 6 to 8 inclusive, engagement of the cam surface portion 108 by the crank pin 92 causes movement of the second movable element 66 from its inoperative position of Figs. 6 and 7 to its operative position of Figs. 8–10 and 14, whereas subsequent engagement of the cam surface portion 109 by the crank pin 91 returns the element 66 to its inoperative position of Figs. 6 and 7.

The gathering elements 64, 65 and 66 are provided with circumferentially extended channel portions 110, 111 and 112 respectively, which cooperate to define a circular channel opening radially inwardly to the opening 107 when the several gathering elements are in their operative position. With reference to Figs. 11–13 it will be seen that said channel is helical in form and provides a guide for a tie wire fed therethrough. The stationary element 64 is provided with a passage 113 which extends laterally thereto and tangentially into the channel portion 111 of the movable element 65. With this arrangement, when a length of tie wire indicated at 114 is fed through the passage 113 and into the channel formed by the several channel portions 110–112, the tie wire is formed thereby into a loop 115 which embraces the gathered portion of the bag top X whereby to hold the same closed.

The tie wire 114 is fed to the gathering elements from a spool 116 upon which the tie wire is wound, said spool being mounted on a supporting shaft 117 that is supported from the frame 4 by a plate-like bracket or the like 118. The tie wire 114 passes through a guide tube 119 which directs the wire between a feed rotor 120 and a cooperating idler wheel 121. A tubular guide 122 extends laterally outwardly from the stationary gathering element 64 to a point adjacent the feed rotor 120 and idler wheel 121, and is provided with a central passage 123 aligned with the passage 113 in the gathering element 64. The idler wheel 121 is journalled on a stub shaft 124 that extends upwardly through a slot 125 in the table section 6 and which is rigidly secured at its lower end to a mounting bar 126 underlying the table section 6 and pivotally secured thereto for swinging movements as indicated at 127, see Fig. 16. It will be noted that the feed rotor 120 and idler wheel 121 are on parallel axes, the peripheral edges thereof being in opposed relationship. It will further be noted that the peripheral edge of the idler wheel 121 is provided with a relatively shallow circumferential groove 128 whereas the peripheral surface of the feed rotor 120 is corrugated or knurled as indicated at 129. The idler wheel mounting arm 126 is yieldingly biased in the direction of the feed rotor 120 by a coil compression spring 130 that is interposed between the outer end portion of the arm 126 and the inner end of an adjustment screw or the like 131 that is screw threaded into a mounting bracket 132 rigidly secured to the undersurface of the table section 6. The tie wire 114 passes from the spool 116 through the guide tube 119 and between the feed rotor 120 and the idler wheel 121 into the passage 123 in the tubular guide 122. Said tie wire is of a diameter greater than the depth of the circumferential groove 128 in the idler wheel 121 so that a surface portion of the wire 114 is engaged by the corrugations or knurling 129 of the rotor 120. Manipulation of the adjustment screw 131 varies the pressure of the idler wheel 121 on the tie wire 114 therebetween and the feed rotor 120, whereby to vary the effective feeding pressure of the feed rotor 120 against the tie wire 114. The feed rotor 120 is journalled on a stub shaft 133 rigidly secured to the table section 6, and is suitably coupled to a feed wheel 134 for common rotation therewith. The feed wheel 134 is provided with a plurality of circumferentially spaced radially outwardly opening notches 135 which receive the crank pin or roller 92 whereby the feeding rotor 120 is rotated to feed a predetermined length of tie wire 114 to the circular channel in the gathering elements 64, 65 and 66. The arrangement is such that, there being four notches 135 in the wheel 134, the feeding rotor 120 is rotated one-quarter turn for each operational cycle of the machine. In order to insure proper positioning of the notches 135 for reception of the crank pin 92 therein, I provide indexing means comprising a plurality of circumferentially spaced openings 136 in the feed rotor 120 and a leaf spring 137 anchored at one end to the undersurface of the table section 6. The spring 137 has a detent portion 138 which enters successive ones of the openings 136 to prevent the feed rotor 120 from rotating beyond a predetermined extent as

the crank pin 92 leaves a given notch 135. With reference to Figs. 10 and 16, it will be seen that the table section 6 is provided with an enlarged opening 139 through which the detent portion 138 of the spring 137 operates to engage the openings 136 in the rotor 120. It should be noted that, for ease of manufacture, that portion of the table portion 6 that carries the feed rotor 120 and idler wheel 121 comprises a separate plate-like element 140 that is screwed or otherwise rigidly anchored to the main portion of the table section 6. It will further be noted that one end of the connecting bridge 14 is anchored to the plate-like element 140.

For the purpose of preventing overrunning of the tie wire carrying spool 116 after a predetermined length of the tie wire 114 is stripped therefrom, I provide a friction brake comprising a lever 141 pivotally secured intermediate its ends to the undersurface of the table section 6 as indicated at 142. The lever 141 is provided at its outer end with a shoe 143 that engages one of the flanges of the spool 116, and is yieldingly biased toward engagement of the shoe 143 with said spool flange by a coil tension spring 144 anchored at one end to the lever 141 and at its other end to the frame structure 4. Means for releasing the brake comprises a cam 145 fast on the lower end of the shaft 57 and arranged to release the brake against bias of the spring 144 only during such time as when the feeding rotor 120 is being rotated by the action of the crank 90. After a predetermined length of tie wire has been looped around the gathered portion of the bag Y the loop 115 must be severed from the unused portion of the tie wire 114 so that the bag may be removed from the machine. To accomplish this end, I provide means for moving the movable elements 65 and 66 longitudinally rearwardly of the direction of travel of the bag through the machine a distance sufficient to cause the tie wire 114 to be sheared at the end of the passage 113 adjacent the channel portion 111 of the movable element 65. Such means comprises a cut-off lever 146 pivotally secured to the stationary gathering element 64 by means of a nut-equipped stud 147. The lever 146 at one end is formed to provide a lug 148 which contacts the front end 149 of the movable element 65 when said movable element is moved to its operative position in engagement with the stationary element 64. A secondary lever 150 overlies the lever 146 and has its inner end pivotally mounted on the stud 147. The other end of the lever 146 is provided with a lock nut-equipped stud 151 which engages the intermediate portion of the secondary lever 150 whereby the lever 146 may be moved in one direction by the secondary lever 150. At its free end portion, the secondary lever 150 is provided with a cam surface portion 152 that is engageable by the crank pin or roller 92 as the crank pin moves out of engagement with one of the notches 135 in the wire feeding wheel 134. Rotation of the crank 90 causes the crank pin or roller 92 to move the secondary lever 150 and the lever 146 in a direction whereby the lug 148 moves the movable gathering elements 65 and 66 in a direction rearwardly of that of the feeding movement of bags through the machine and against bias of the springs 73 and 100 associated with their respective arms 69 and 96. This rearward movement of the gathering elements 65 and 66 causes the bottom portion 111*a* of the channel portion 111 to engage the tie wire 114 at the point of emergence thereof from the passage 113 and shear the wire 114 at this point, thus severing the finished loop 115 from the remainder of the tie wire in the machine, see Fig. 14. The secondary lever 150 is limited in its swinging movement in opposite directions by a pin 153 which projects upwardly from the table section 6 and which is received in a notch 154 in the free end of the secondary lever 150. The notch 154 is of a length to permit free swinging movement of the secondary lever 150 to the extent necessary to cause severing of the tie wire 114 plus whatever may be needed for adjustment between the secondary lever 150 and the lever 148 during assembly of the machine, such adjustment being made by the adjusting screw 151.

The gear 56 is formed to provide internal clutch-acting teeth 155 which are adapted to have driving engagement with teeth 156 of a pawl 157 that is pivotally mounted, as indicated at 158, on a generally circular plate-like member 159. The plate-like member 159 is keyed to the shaft 57 for common rotation therewith and is provided with an upstanding lug 160 between which and the pawl 157 is interposed a coil compression spring 161. The spring 161 yieldingly urges the pawl 157 in a direction to cause engagement of the teeth 156 with the internal teeth 155 of the gear 56 whereby to releasably lock the continuously rotating gear 56 in driving engagement with the plate-like member 159 and shaft 57. The pawl 157 has an offset radially outwardly projecting finger 162 which is engageable with a stop element in the nature of a rock shaft 163 journalled in the transmission housing 9 radially outwardly of the gear 56. The shaft 163 is provided with a transverse groove 164 through which, when the shaft 163 is rotated to a predetermined point, the finger 162 is adapted to pass during rotation of the plate-like member 159. Normally, the shaft 163 is disposed in the position shown in Fig. 3 whereby the shaft 163 will intercept the finger 162 thereby causing relative rotation between the pawl 157 and the plate-like member 159 to disengage the same from driving engagement with the gear 56. Rigidly secured to the rock shaft 163 is a cam 165 to which is pivotally connected one end of a rigid link 166. The other end of the link 166 is pivotally secured to the outer end of a crank arm 167 which has its inner end rigidly secured to an actuator shaft 168 which is journalled in the bottom wall of the transmission housing 9, and to the lower end of which is rigidly secured an actuator in the nature of a control finger 169. The control finger 169 is located below the plane of the conveyor chains 15 and 16 and above the plane of the gathering elements 64, 65 and 66 and normally lies in the path of travel of bags carried by the chains 15 and 16 through the passageway 8. A rigid link 170 has one end pivotally secured to the outer end of the crank arm 167 in common with the adjacent end of the link 166, and its other end pivotally secured to one end of a lever 171 pivotally secured intermediate its ends to the bottom wall of the transmission housing 9 as indicated at 172. A coil tension spring 173 has one end secured to the link 170 and its other end to a bearing bracket 174 which bracket forms a bearing for the upper end of the rock shaft 163. Movement of the actuator or control finger 169 from its position of Fig. 3 to its position of Fig. 4 by a bag passing through the passageway 8 causes rotation of the rock shaft 163 in a direction to place the groove or notch 164 in registration with the outer end of the finger 162 and permitting the spring 161 to rotate the pawl 157 to a point where the teeth 156 engage the internal teeth 155 of the gear 56. This engagement causes the plate-like member 159 and the shaft 57 to rotate in a clockwise direction. The lever 171 has a free end portion 175 which is moved into the path of travel of the finger 162 when the actuator or control finger 169 is moved to its position of Fig. 4. In the event that the spring 173 does not move the control finger 169 to its position of Fig. 3, the finger 162 engages the end 175 of the lever 171 with a camming action thereby moving the lever 171 in a direction to positively move the control finger 169 to its bag engaging position of Fig. 3 with consequent movement of the rock shaft 163 back to its finger intercepting position of Fig. 3. Thus, when the plate-like member 159 and shaft 57 have made one complete revolution, the rock shaft 163 will intercept the finger 162 of the pawl 157 and cause disengagement of the pawl from the internal teeth

155 of the gear 56. For the purpose of preventing reverse rotation of the plate-like member 159 and shaft 157 upon completion of a single revolution thereof, I provide a stop arm 176 pivotally secured at one end to the bottom wall of the transmission housing 9 as indicated at 177, and having its other end receivable in a notch 178 in the peripheral edge of the plate-like member 159. As shown, the stop arm 176 is yieldingly urged toward engagement with the plate 159 by a coil tension spring 179. For further insuring that no more than one revolution is imparted to the plate-like member 159 and shaft 57 during a single operational cycle of the machine, I provide a pin 180 which projects radially outwardly from the plate-like member 159 in circumferentially spaced relation to the pawl 157 and disposed ahead of said pawl in the direction of rotation of the gear 56 and plate-like member 159. In the event that engagement of the pawl finger 162 with the cam-acting end 175 of the lever 171 fails to cause rocking movement to be imparted to the rock shaft 163 to the extent that the shaft 163 will intercept the finger 162, the pin 180 is adapted to engage a cam surface portion 181 of the cam 165 and positively move the same to the desired extent before the finger 162 reaches its point of engagement with the shaft 163. The cam portion 175 of the lever 171 and the radial pin 180 are both considered necessary to the foolproof operation of the clutch mechanism by reason of the fact that the spring 173 must be relatively weak to permit easy movement of the actuator or control finger 169 by bags passing through the machine. With the above arrangement the impact of a bag made from relatively light weight soft pliable material such as cloth, polyethylene and the like, will be sufficient to cause the operational cycle to be initiated and return of the control finger 169 to its normal bag intercepting position, and the rock shaft 163 to its finger intercepting position will be assured.

Operation

Assuming that the plug 62 is connected to a source of electrical power, the switch 63 is closed to cause energization of the drive motor 48 whereby to cause continuous and uninterrupted feeding movement to be imparted to the chains 15 and 16 and to the gear 56. Then, when a bag Y is fed to the machine so that the open top X thereof enters the passageway 8, said top is gripped by the chains 15 and 16 and moved rapidly in a direction from the right to the left with respect to Figs. 1 and 2. This movement causes the bag to engage and move the actuator or control finger 169 whereby to cause engagement of the pawl 157 with the driving teeth 155 of the gear 56. It will be noted that the control finger 169 is located slightly below the plane of the feed chains 15 and 16 so that the weight of the material in the bag Y maintains the bag material in a sufficiently taut condition to cause clutch actuating movement to be imparted to the actuator or control finger 169. As hereinbefore described, the control mechanism including the shaft 163, the cam 165, pawl 157 and linkage between the control finger 167 and the cam 165 are so arranged that the shaft 57 and crank 90 thereon make but one revolution for each operating cycle of the machine. Initial rotary movement of the shaft 57 and crank 90 causes the cam surface portion 93 of the cam 76 to be engaged by the crank roller 92 whereby to cause the first movable gathering element 65 to move transversely into engagement with the stationary gathering element 64 whereby to stop feeding movement of the bag. The crank 90 continues to rotate until the crank roller 92 engages the cam surface portion 108 on the cam 97, thus moving the cam 97 in a direction to feed the second movable gathering element 66 laterally into the passageway 8 and forwardly toward engagement with the stationary gathering element 64 and the first movable element 65. During the time that the crank 90 has moved out of engagement with the cam surface portion 93 and into engagement with the cam surface portion 108, the feed chains 15 and 16 have moved the entire top portion of the bag forwardly of the arcuate front end 106 of the gathering element 66 and partially gathered the bag top against the juxtaposed gathering elements 64 and 65. Then, when the crank roller 92 engages the cam surface portion 108, the movable element 66 completes the gathering operation as it moves forwardly between the guide member 103 and the guide track 104 into engagement with the gathering elements 64 and 65. Immediately upon this engagement of the several gathering elements, the crank pin or roller 92 enters one of the notches 135 in the wheel 134 to impart feeding rotation to the wire feed rotor 120. Rotation of the rotor 120 will cause the length of tie wire 114 to be fed through the passage 113 in the stationary gathering element 64 and into the aligned channel portions of the various gathering elements to an extent that the tie wire makes a loop about the gathered portion of the bag, said loop comprising approximately one and one-quarter turns about the bag top. As the crank pin 92 leaves the notched wheel 134, it engages the cam surface portion 152 of the secondary lever 150 moving the same in a direction to cause the lug 148 on the cooperating lever 146 to move the movable members 65 and 66 rearwardly against bias of their respective associated springs 73 and 100. As hereinbefore described, this movement causes the loop 115 to be sheared from the tie wire 114 at the mouth of the guide passage 113 adjacent the channel portion 111 of the movable element 65. Further movement of the crank 90 causes the crank pin 92 to engage the cam surface portion 94 of the cam 76 to transversely move the movable element 65 away from engagement with the stationary gathering element 64. Almost simultaneously, the crank pin or roller 91 engages the cam surface portion 109 on the cam 97 and moves the cam 97 in a direction to retract the movable element 66 longitudinally out of engagement with the stationary gathering element 64 and laterally out of the passageway 8. At this point the shaft 57 has rotated to a point where the finger 162 on the pawl 157 engages the shaft 163, thus causing disengagement between the teeth 156 on the pawl 157 from the inner teeth 155 of the gear 56 and stopping rotation of the shaft 57. The machine is now ready for a subsequent operational cycle. Inasmuch as the feed chains 15 and 16 engage the very top portion of the bag, and the gathering elements are located an appreciable distance below the gathering chains, despite continued movement of the extreme top of the bag in a forward direction during the interval in which the tie wire is being applied to the bag, the chain engaged portion of the bag is fed outwardly but a very short distance to the outer end of the gripping area of the chains. Furthermore, the wire feeding and severing operation and subsequent movement of the gathering elements to their inoperative bag releasing positions occurs so rapidly that the filled bag Y loses little, if any, of its forward movement through the machine during the gathering and tying operation. Thus, tearing of the bag or otherwise straining the same during the tying operation is virtually eliminated, the closing and tying thereof becomes an almost instantaneous operation.

When it is desired to open the bag Y, the wire loop 15 may be moved to and beyond the end of the bag with relative ease and without the necessity of first opening or enlarging the loop 15. However, the loop 15 grips the gathered portion of the bag with sufficient force to prevent slippage which might otherwise be imparted thereto by weight of the contents of the bag.

Although my novel mechanism has been described as gathering and closing bags, the same is equally capable of gathering and closing any package or wrapping formed to provide an open end. Thus, a sheet of flat soft material, such as polyethylene, cloth or the like, may be

wrapped around an article and the open end or ends thereof inserted between the feed chains in the same manner as a bag top, and similarly gathered and tied closed.

My invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the objectives set forth; and while I have shown and described a preferred embodiment of my novel bag closing and tying machine, it will be understood that the same is capable of modification without departure from the spirit and scope of the invention as defined in the claims.

What I claim is:

1. In a bag closing machine, means engageable with the open upper end portion of filled bag adjacent the top thereof for transporting the bag, mechanism disposed below the plane of said transporting means for engaging the open upper end portion of the bag during transporting movement thereof and gathering said upper end portion into closed relationship above the central portion of the bag, said mechanism including gathering elements movable between inoperative positions in spaced apart relationship out of the path of travel of the bag and bag closed operative positions in engagement with each other and the upper end portion of the bag, said elements cooperating to define an opening through which the gathered portion of the bag extends and a guide channel encircling the gathered portion of the bag when said elements are in their operative positions, and means for automatically feeding a predetermined length of tie wire through said channel, whereby to form said tie wire into a loop to hold the bag top portion in gathered relationship.

2. The structure defined in claim 1 in which said bag transporting means comprises a pair of endless belts mounted with longitudinally extended portions of their outer peripheral surfaces in face-to-face contact with each other, whereby to firmly grip opposite sides of a bag fed therebetween, said gathering elements being movable in a plane below the plane of said belts, and means for imparting continuous and uninterrupted bag feeding movement to said belts.

3. The structure defined in claim 2 in further combination with control means for said bag top gathering mechanism, said control means including an actuator normally lying in the path of travel of the bag and between the plane of the bag transporting means and that of said gathering elements, engagement of said actuator by the bag causing said gathering elements to be moved from their inoperative positions to their bag engaging operative positions.

4. In a bag closing machine, means engageable with the open upper end portion of a filled bag adjacent the top thereof for transporting the bag, mechanism for engaging the open upper end portion of the bag during transporting movement thereof and gathering said upper end portion into closed relationship above the central portion of the bag and below the horizontal plane of the transporting means, said mechanism including a stationary element and a pair of other elements mounted for movements between inoperative positions in spaced apart relationship out of the path of travel of the bag and operative positions in engagement with each other and said stationary element, said elements cooperating to define an opening through which the gathered portion of the bag extends and a guide channel encircling the gathered portion of the bag when said elements are in their operative positions, means for automatically feeding a predetermined length of tie wire through said channel, whereby to form said tie wire into a loop to hold the bag top portion in gathered relationship, operating mechanism for moving said movable elements toward and away from each other and said stationary element, and bag actuated control means for said operating mechanism.

5. In a bag closing machine, a pair of cooperating endless link chains having longitudinally extended outer peripheral surface portions in face-to-face contact with each other, means for imparting continuous and uninterrupted feeding movement to said chains, means defining opposed parallel guide channels for said chains, said guide channels being spaced apart a distance to maintain said outer peripheral surface portions of the chains in face-to-face engagement and permitting the upper end portion of a bag to be received between said surface portions, a stationary gathering element mounted in the path of travel of the upper bag end portion and receiving the same from said chains, a pair of movable gathering elements mounted for movements between inoperative positions in spaced apart relationship and operative bag closing positions in engagement with each other and with said stationary element, said elements cooperating to define an opening through which the gathered portion of the bag extends when said elements are in their operative positions, said elements further defining circumferentially extended channel portions which cooperate to provide a circular channel opening radially inwardly to said opening when said elements are moved to their operative positions, one of said elements having a passage opening tangentially into the channel portion of an adjacent element, means on said machine for supporting a spool of tie wire, mechanism for feeding a predetermined length of said tie wire through said passage and channel, whereby to form a loop about the gathered portion of said bag, and mechanism for imparting movement to the element adjacent said passage-equipped element in a direction to sever the loop from the portion of tie wire in said passage.

6. The structure defined in claim 5 in further combination with a releasable brake mounted for movements into and out of braking engagement with said spool, and means for releasing said brake during wire feeding movement of said spool and for setting the brake to stop rotation of the spool when the wire feeding operation is completed, said last-mentioned means comprising a spring yieldingly urging said brake toward said spool, and a power operated cam engaging said brake to release the same against bias of said spring only during feeding movements of said wire.

7. In a bag closing machine, a table comprising a pair of laterally spaced table elements defining a passageway therebetween, a pair of horizontally disposed cooperating endless belts mounted in upwardly spaced relation to said table with longitudinally extended portions of their outer peripheral surfaces in face-to-face contact with each other above said passageway and parallel thereto, whereby to firmly grip opposite sides of a bag fed therebetween, mechanism disposed below the plane of said belts for gathering the upper end portion of the bag, said mechanism comprising a relatively stationary gathering element mounted on one of the table elements and first and second relatively movable gathering elements each mounted on a different one of said table elements for movements between inoperative spaced apart positions and operative bag closed positions in engagement with each other and with said stationary gathering element, said gathering elements each having arcuate surface portions cooperating to define a circular opening through which the gathered portion of the bag extends, said arcuate surface portions having circumferentially extended grooves cooperating to provide a guide channel encircling said gathered portion of the bag, means on one of said table elements for guiding said second gathering element into operative engagement with the others thereof, said last-mentioned means including a retaining lip for holding said second gathering element against movement away from its respective table element, whereby to guide said second gathering element into proper registration with said stationary gathering element, said first movable gathering element and its respective table element defining aligned guideways in opposed relation to the guide means on said one of the tables, said second gathering element having a longitudinally extended flange projecting laterally therefrom and receivable in

said guideways to maintain said movable elements in proper alignment, and means for automatically feeding a predetermined length of tie wire through said channel whereby to form said tie wire into a loop for holding the bag top portion in gathered relationship.

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