July 4, 1944. E. BEHRENT ET AL 2,353,005

AUTOMATIC PACKAGING MACHINE

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Fig. 1.

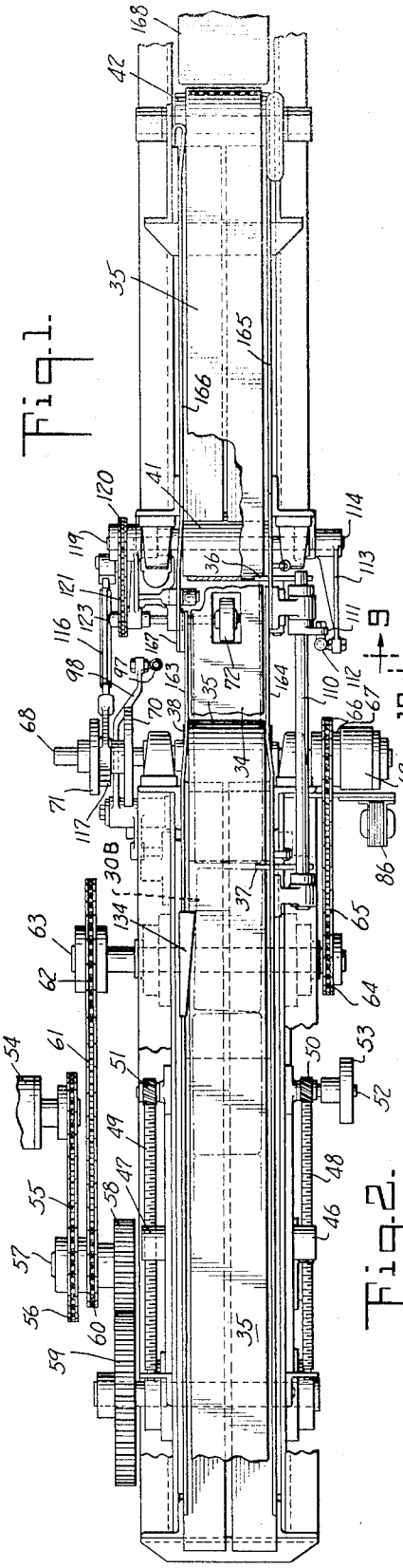
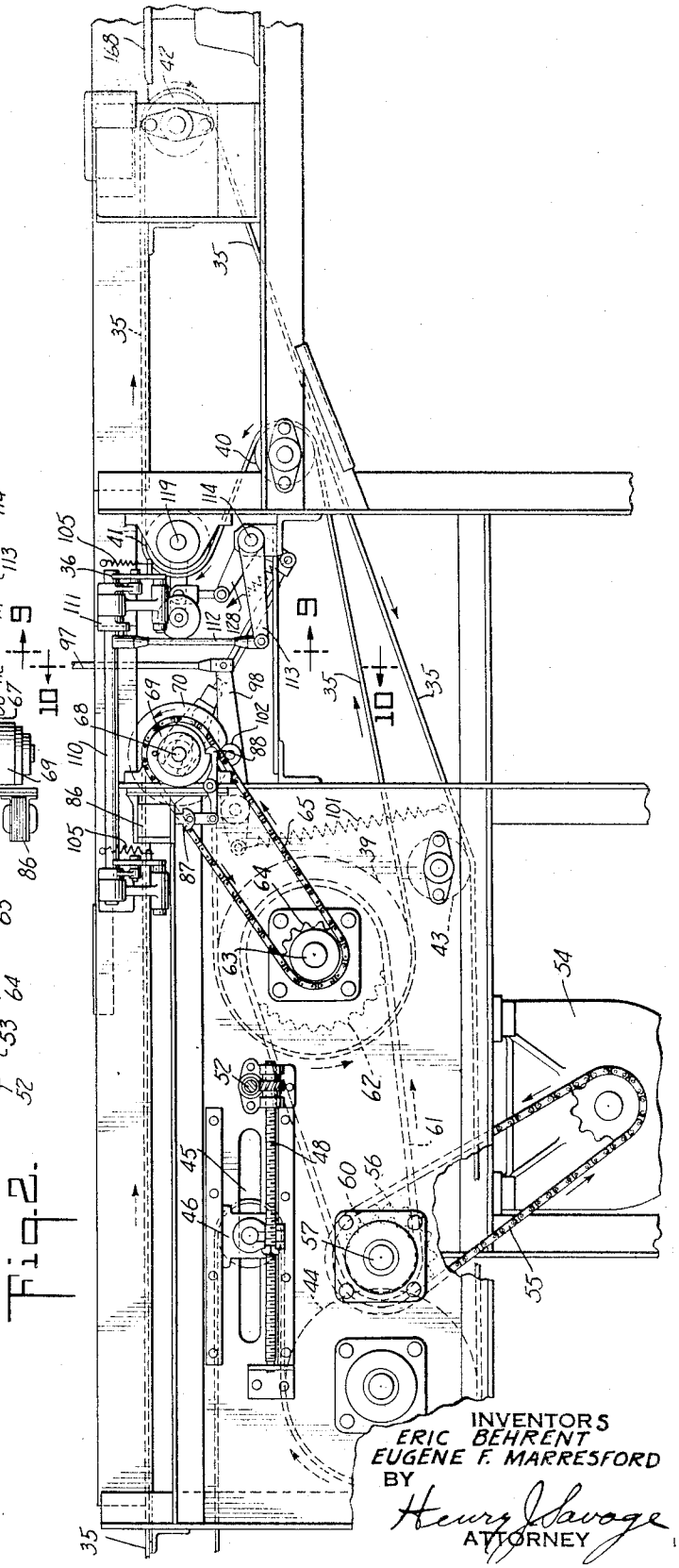


Fig. 2.



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AUTOMATIC PACKAGING MACHINE

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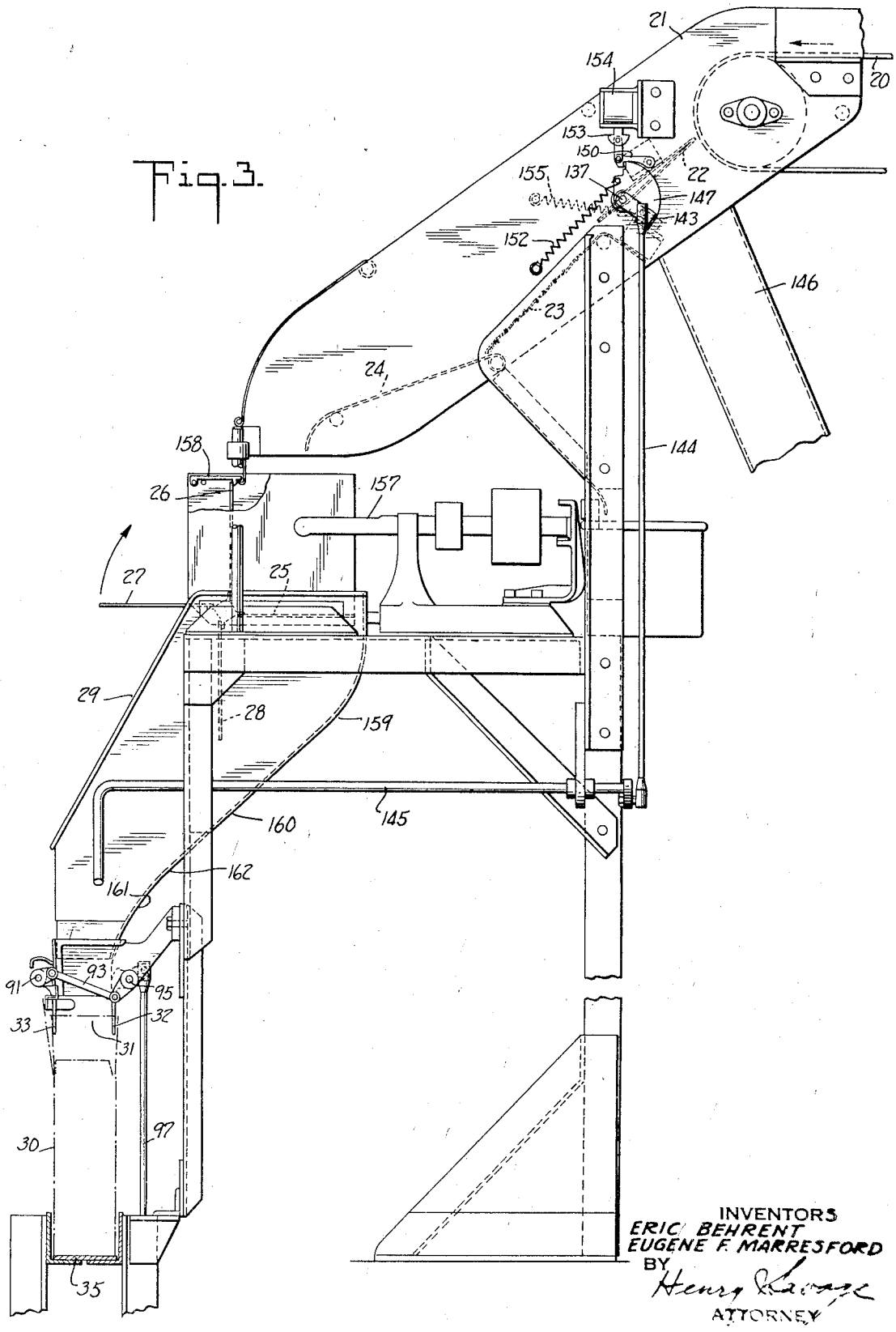
Fig. 3.



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AUTOMATIC PACKAGING MACHINE

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Fig. 4.

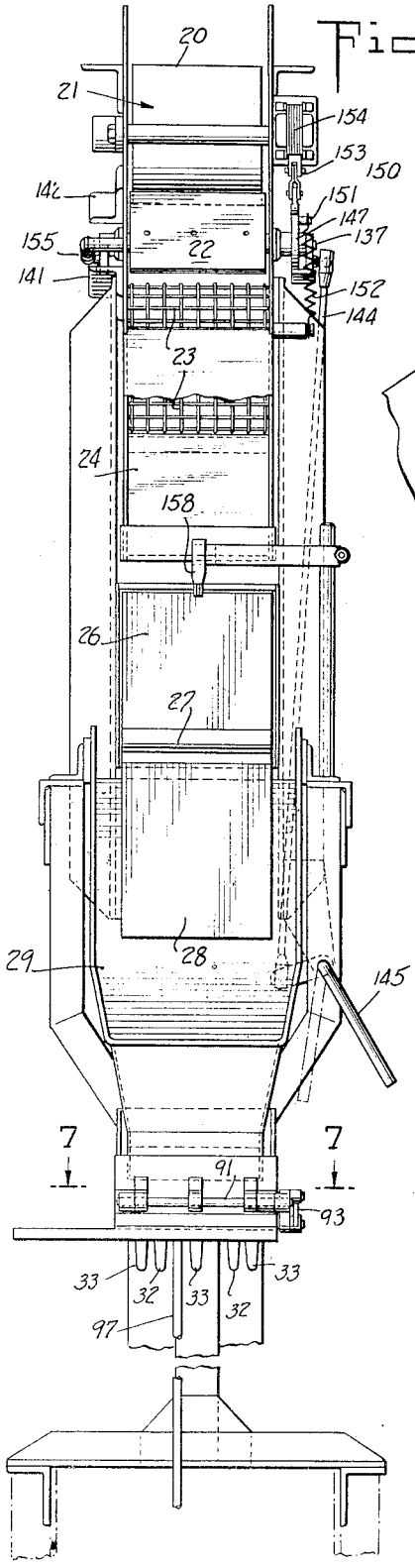

Fig. 5.

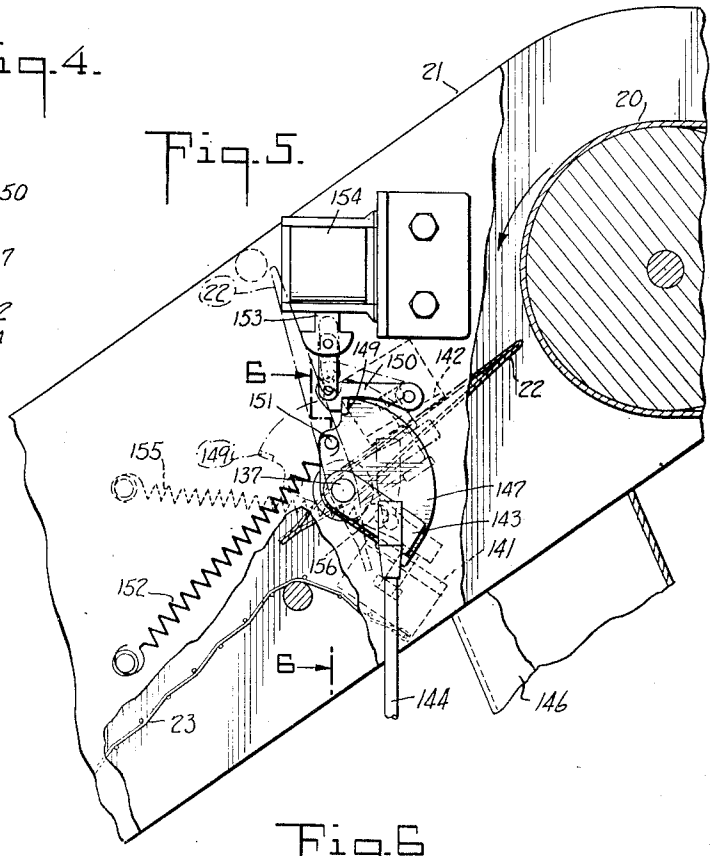

Fig. 6

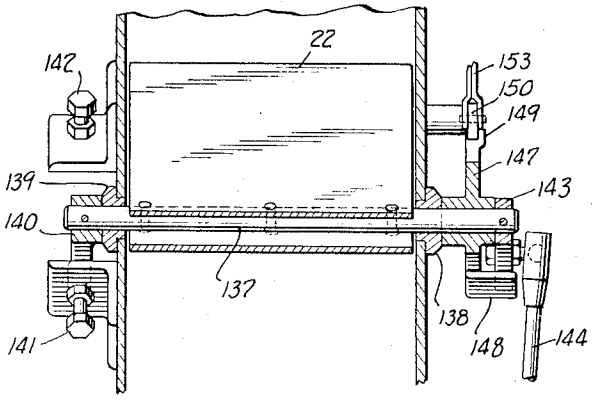

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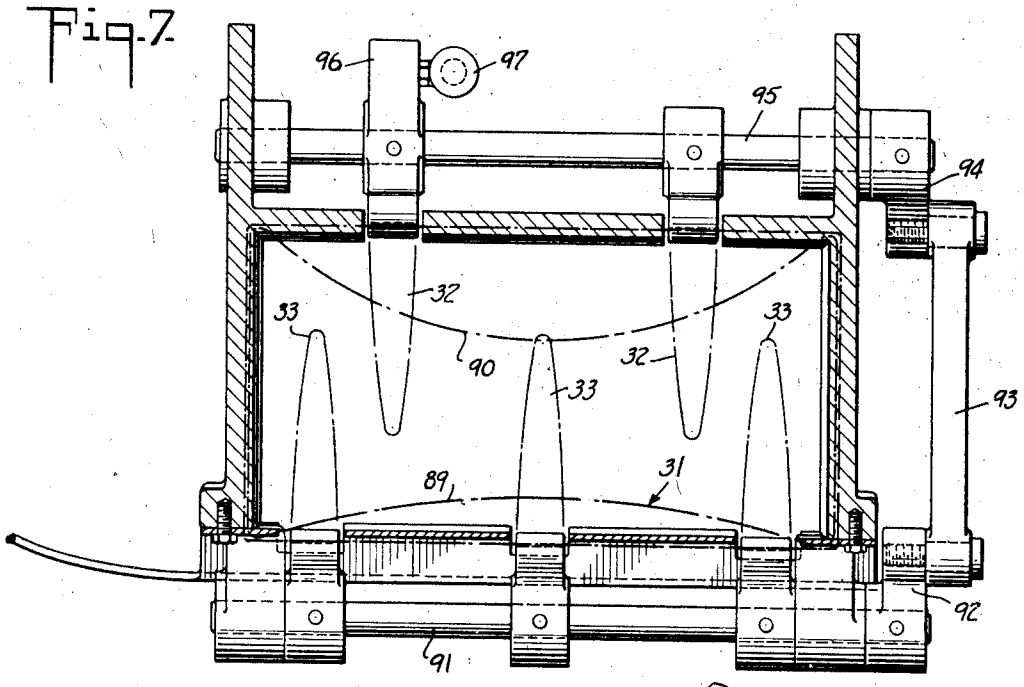
Fig. 7.



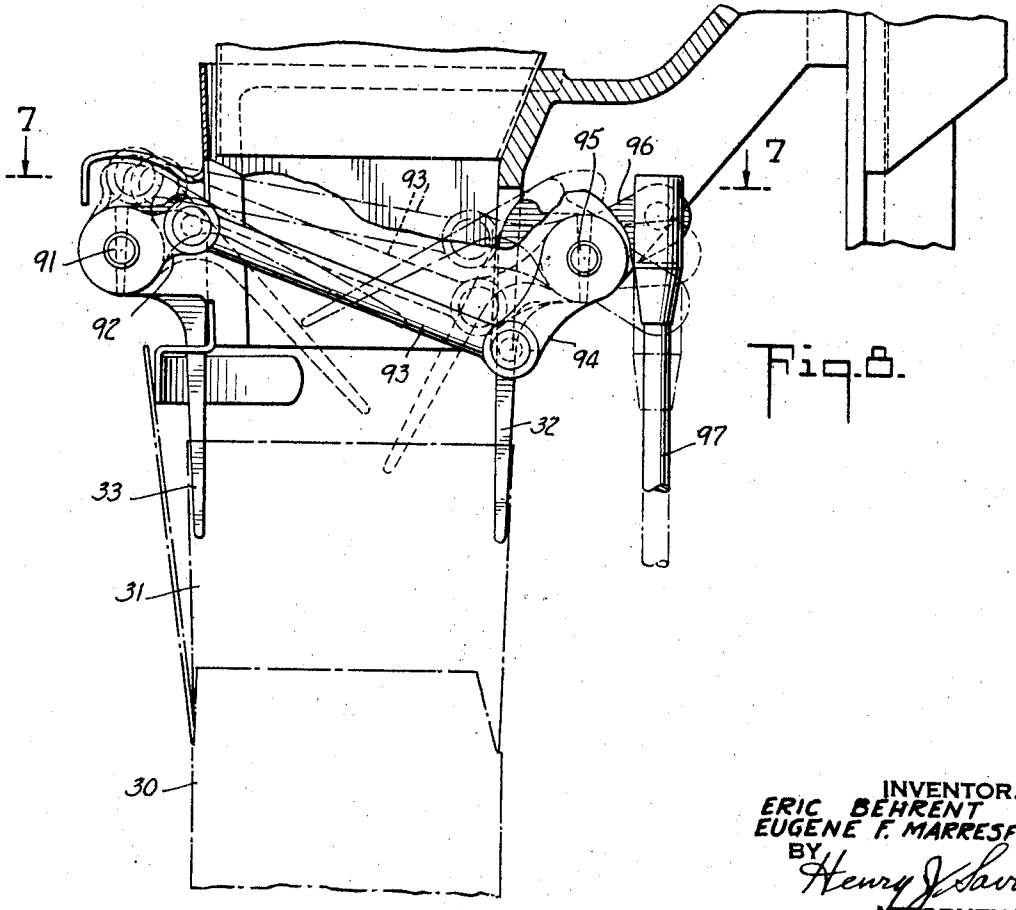


Fig. 8.

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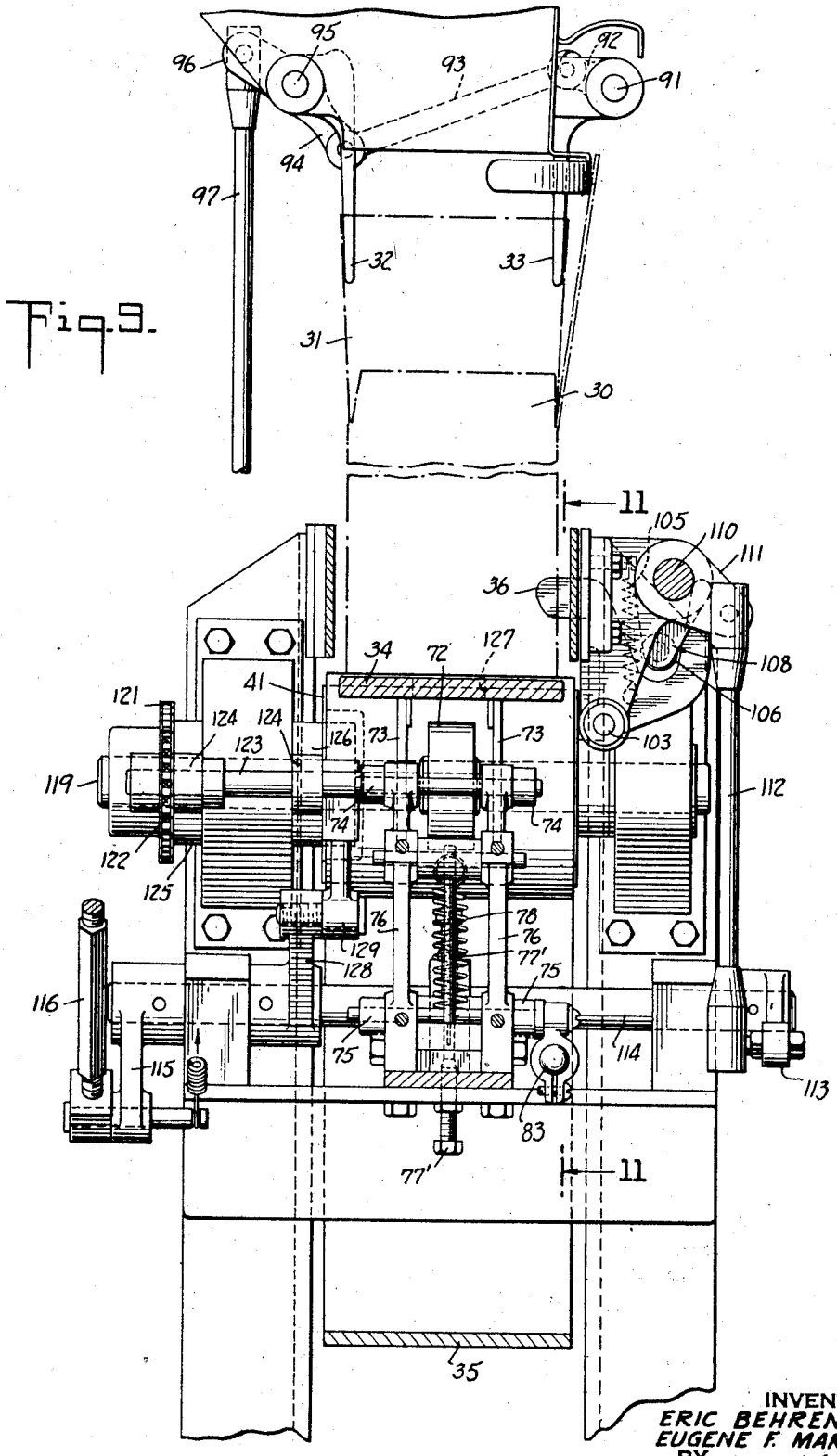
Fig. 9.



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AUTOMATIC PACKAGING MACHINE

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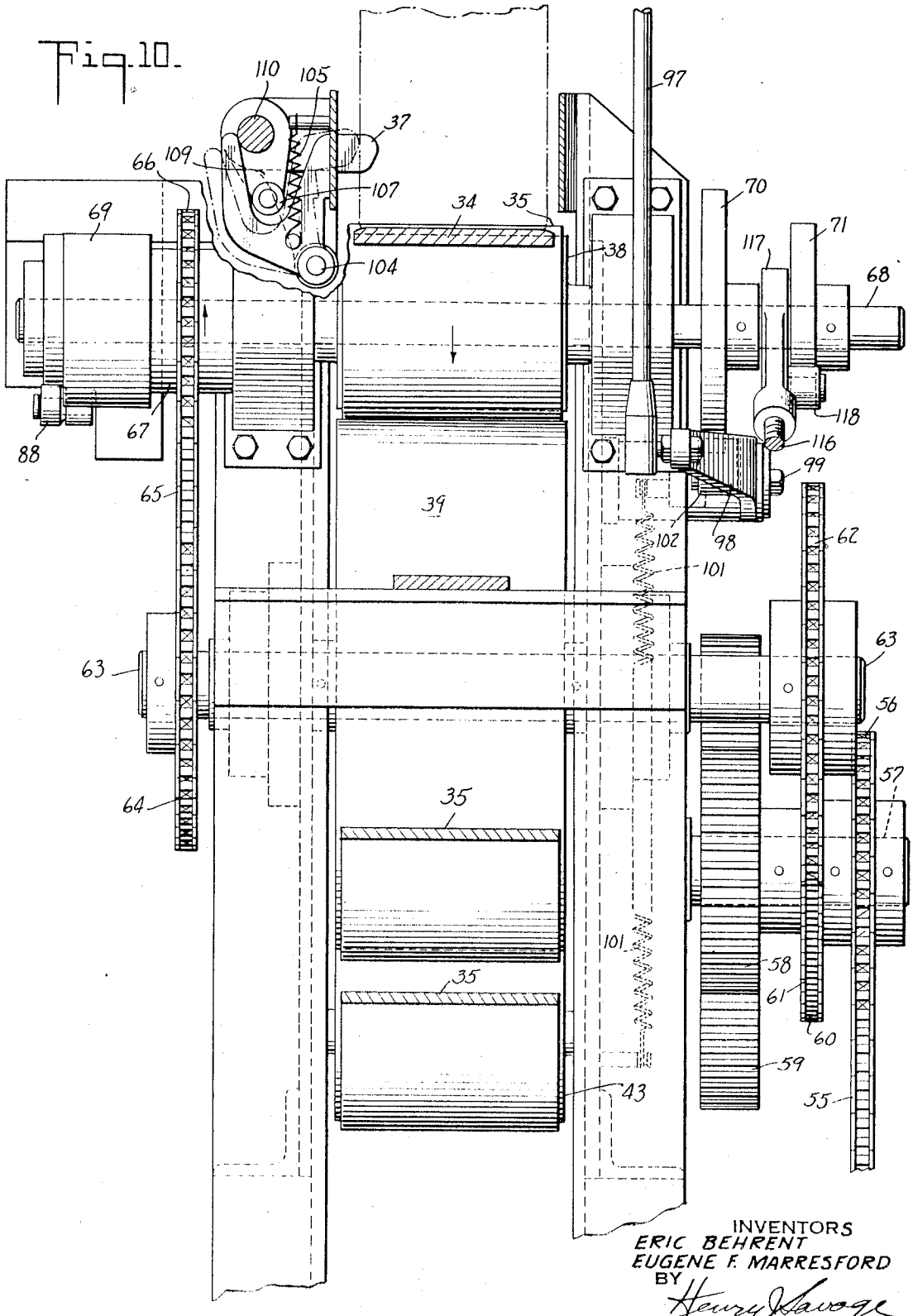
Fig. 10.



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AUTOMATIC PACKAGING MACHINE

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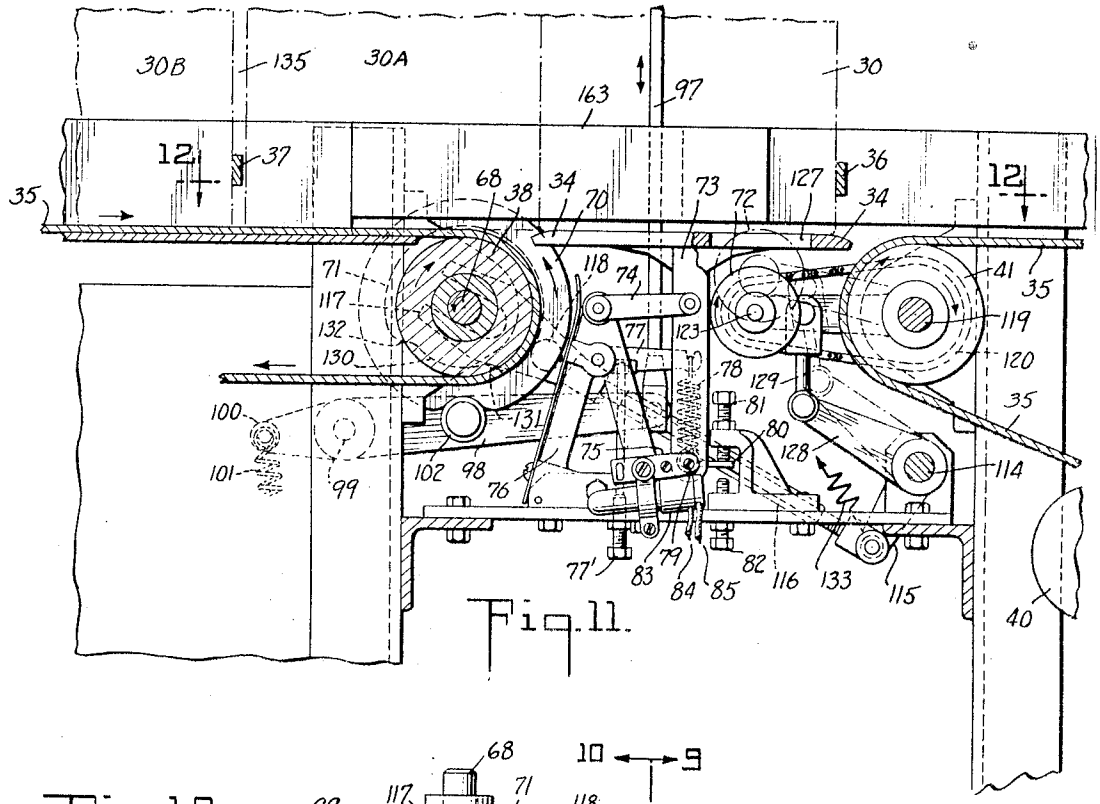
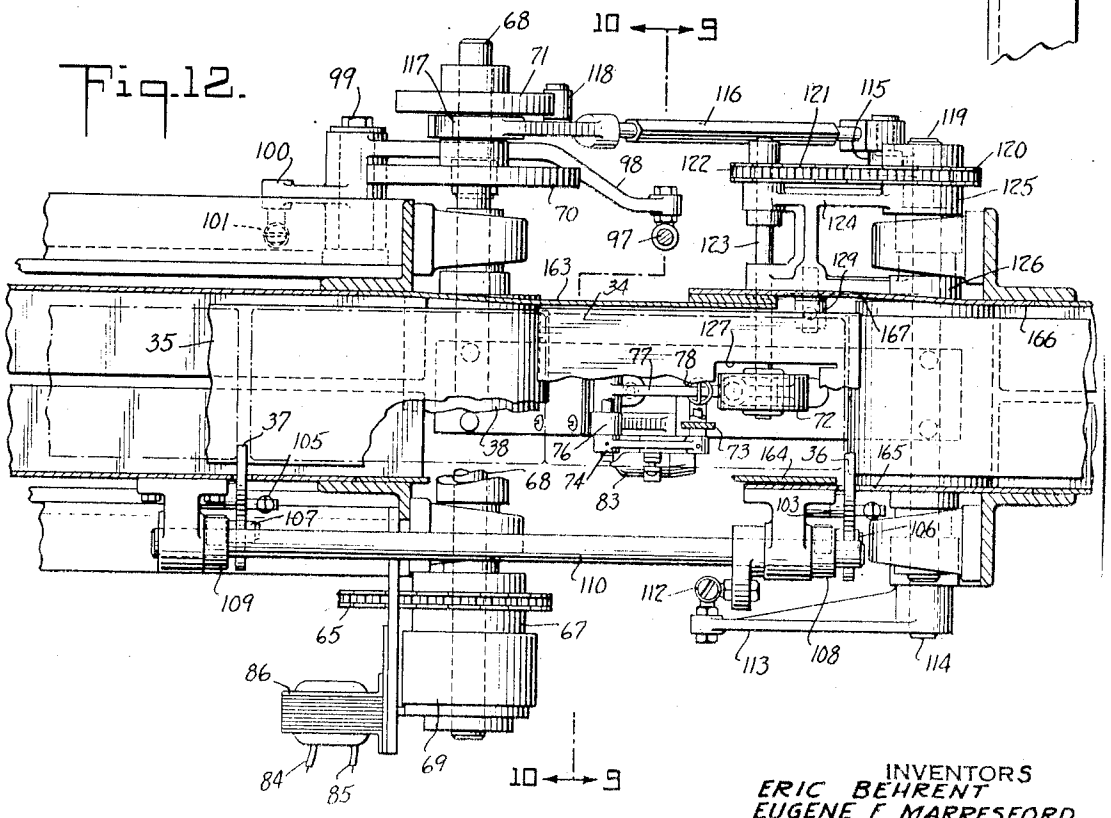


Fig. 11.

Fig. 12.



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Patented July 4, 1944

2,353,005

UNITED STATES PATENT OFFICE

2,353,005

AUTOMATIC PACKAGING MACHINE

Eric Behrent, East Rutherford, N. J., and Eugene F. Marresford, Baldwin, N. Y., assignors to National Biscuit Company, New York, N. Y., a corporation of New Jersey

Application October 12, 1940, Serial No. 360,944

11 Claims. (Cl. 249—18)

Our invention pertains to automatic packaging machines and has for its principal object to increase both the speed of operation of such machines and the accuracy of weighing the unit quantity (as 1 lb., ½ lb., etc.) of the product that is filled into each carton or container.

Another object is to provide means whereby a carton or other container being filled is the timing means that controls operation of the machine.

Another object is to provide means whereby a container that is being filled sets the timing means in operation before the filling is completed, so that the lag or time interval necessary for the container moving mechanism to take up the slack therein and begin functioning has elapsed by the time the container is filled and there is no interval between the filling of the container and the start of its removal.

Another object is to provide means for accelerating the removal of a filled container from the point of filling immediately that the container is filled.

Another object is to weigh automatically a unit quantity of material and fill it into a selected one of a line of empty containers that are being advanced by a continuously moving conveyor, in combination with means controlled by the container that is being filled to relieve it from side pressure of its adjacent containers while it is being filled.

Another object is to provide a weighing means and filling chute constructed and cooperating so that a weighed quantity of a product will be fed uniformly from the weighing means along the chute and into the container without clogging, breaking or "bunching."

Another object is to provide a by-pass in the delivery chute to the weighing apparatus which may be operated either manually or by remote electric control to divert the flow of material in case of a "jam" in the weighing apparatus or delivery chute, or mal-functioning of any part of the mechanism.

Another object is to provide an automatic weighing and carton filling machine wherein the cycle of movement of the mechanism is shorter than the time required for filling a carton and in part overlaps the filling, and the carton feeding means operates at a speed sufficient to supply empty cartons faster than they can be filled and removed.

Another object is to provide means, in a carton feeding and filling machine in which the cartons are fed to and from the machine by an endless belt, whereby the last of the cartons in the line or train will be fed to and from the machine without manual assistance.

Another object is to provide an automatic weighing and filling machine wherein the maximum speed of the filling mechanism in filling unit weights or volumes of material into containers exceeds the maximum speed or rate at which the weighing mechanism can weigh or measure the unit quantities.

The above and other objects of the invention are attained by the embodiment thereof shown in the accompanying drawings wherein we have illustrated a carton filling machine particularly adapted for weighing and filling crackers, but the invention is adapted for use with many kinds of products and many kinds of containers. The machine shown is but illustrative of the invention and not a limitation thereon.

Fig. 1 is a top plan view, with the weighing mechanism and delivery chute omitted, of a carton feeding and filling mechanism.

Fig. 2 is a front elevation of Fig. 1.

Fig. 3 is a side elevation of the automatic weighing mechanism and delivery chute, and also shows the carton liner spreader fingers.

Fig. 4 is a front elevation, looking from the left to right of Fig. 3.

Fig. 5 is an enlarged view, with parts broken away, of the by-pass of Fig. 3.

Fig. 6 is a section taken substantially on the line 6—6 of Fig. 5.

Fig. 7 is a section on the line 7—7 of Figs. 4 and 8, showing the liner opening fingers.

Fig. 8 is a view, looking from right to left of Fig. 7, showing the operation of the liner opening fingers.

Fig. 9 is a section taken on the line 9—9 of Figs. 2 and 12, looking in the direction of the arrows.

Fig. 10 is a section taken on the line 10—10 of Figs. 2 and 12, looking in the direction of the arrows.

Fig. 11 is a section taken on the line 11—11 of Fig. 9 showing the mechanism whereby a carton that is being filled controls the timing and operation of the apparatus.

Fig. 12 is a top plan view, as indicated by the line 12—12 on Fig. 11, with parts broken away to show the mechanism beneath.

The machine, which we have chosen to illustrate one embodiment of our invention, is designed for automatically weighing and packaging crackers in waxpaper lined cartons. However, the invention is not limited to this use and

is equally well-adapted for weighing and packaging any kind of material or small articles which will flow readily and containers of any type can be used such as unlined cartons, paper bags, glass jars, fiber containers and the like.

Referring first to Fig. 3, a continuous belt or conveyor 20 carries crackers continuously to the upper end of a delivery chute 21 where the crackers upon leaving the belt flow over a by-pass gate 22 and a coarse screen 23, through which crumbs and small pieces of cracker sift out, thence over a delivery plate 24 to a weighing scale having four rotatable vanes 25, 26, 27 and 28. In some cases the screen 23 is not used, in which case it is covered with or replaced by a sheet metal plate, or spaced parallel bars may be used instead of a screen with some kinds of material. The weighing scale is a commercial article and the vanes are adapted to receive and discharge definite quantities by weight of the crackers in succession. The weighing scale discharges to a filling chute 29, the lower end of which discharges into a carton 30 that is to be filled. The weighing scale is adjusted so that each weighed quantity is sufficient to fill one carton 30. These cartons are lined and the liner 31 extends above the top of the carton and it is held open or spread apart by sets of spreader fingers 32, 33 on two sides while it is being filled by crackers flowing down the filling chute 29.

The carton 30 that is being filled is supported on a movable platform or timing scale 34 (Fig. 11) to which the empty cartons are supplied by a continuously moving endless belt 35. When the carton on the timing scale is filled it is automatically removed and the next carton on the belt 35 is moved into position to receive the next lot of crackers. The timing scale is actuated by the weight of the partly filled carton while it is being filled and controls the operation of the fingers 32, 33 which open the liner and of stops 36, 37 which engage the carton that is being filled so as to properly locate it on the timing scale under the filling chute and a following empty carton in the line, so as to prevent the following cartons from pressing on the carton that is being filled. The control mechanism is set in operation by movement of the timing scale due to the weight of the carton while it is being filled so that all of the slack in the mechanism has been taken up and the time necessary for it to start functioning has elapsed by the time that the complete charge is received in the carton so that there is no delay in removing the filled carton and bringing the next empty carton into position. In other words, the carton which is being filled is itself the timing means which controls the operation of the machine. By this means a filled carton will be removed the instant that it has been filled and if there is any delay in filling it, it will remain in position until the filling operation is complete. This has enabled us to speed up the operation of weighing unit quantities of the crackers (as say, one-half pound or pound units) and placing them in cartons two, three or four times the maximum speed that has been attainable heretofore.

Referring now to Figs. 1 and 2, the belt 35 that carries the empty cartons to the timing scale and carries away the filled cartons comes in from the left in these figures and passes around a pulley 38 which is adjacent the entrant edge of the timing scale platform 34. The belt then passes over one of two driving pulleys 39, thence over an idler 40 and around a pulley 41 adjacent the delivery end of the timing scale 34. The belt then passes around an idler 42 and back over another idler 43 and around a second driving pulley 44 from which it passes around a take-up pulley 45; thence back to the left where it passes around another idler to come up to the upper run of the belt 35 where it receives the empty cartons from the carton forming and lining machine.

The take-up pulley 45 is mounted on a shaft which rotates in a pair of sliding blocks 46, 47 supported on guideways and in which the screw threaded shafts 48, 49 engage. Each of these shafts near its righthand edge carries a spiral gear which meshes with similar spiral gears 50, 51 keyed to a shaft 52 to one end of which the hand wheel 53 is fixed. Rotation of the hand wheel 53 will move the sliding bearings 46, 47 and the pulley 45 with them to adjust the tension of the belt 35.

The belt is driven from any suitable source of power as an electric motor 54 which through a chain 55 drives a sprocket 56 which is keyed to a shaft 57. The shaft 57 carries a gear 58 meshing with a gear 59 keyed to the shaft driving pulley 44. The shaft 57 also carries a sprocket 60 which through a chain 61 drives a sprocket 62 keyed to the shaft 63 that drives the driving pulley 39. It will be noted that the two driving pulleys 39, 44 rotate in opposite directions to drive the belt 35.

The shaft 63 extends across the machine and on its opposite sides carries a sprocket 64 which drives a chain 65, running over a sprocket 66 that is connected to one element of a one-revolution clutch 67 which normally rotates freely on a cam shaft 68 to which the other element 69 of the one-revolution clutch is fixed. This clutch is a usual type of one-revolution clutch, such for example as the single revolution clutch made by The Hilliard Corporation, and need not be described in detail, because its construction is well known to engineers and mechanics and, per se, it is not part of our invention. The shaft 68 carries a cam 70 which controls the operation of the liner spreader fingers 32, 33 and also carries a cam 71 which controls the operation of the stops 36, 37 and also of an accelerating roller 72, the function of which is to engage the bottom of a carton that has been filled on the timing scale and accelerate or assist in its removal therefrom so that the next empty carton can be moved into filling position promptly by the belt 35.

The operation of this timing mechanism is best illustrated in Figs. 9 to 12. The platform of the timing scale 34 is secured to a pair of depending arms 73 which are connected to the free ends of a pair of long links 74 and at their lower ends are similarly connected to a pair of short links 75. The other ends of the links 74 and 75 are pivotally connected to a triangularly shaped frame 76. This frame has a forwardly projecting arm 77 pivotally connected with it to which one end of a coil spring 78 is connected, the lower end of the coil spring being connected to a pin 79 which connects the links 75 to the lower ends of the arms 73. The tension of the spring is selected or adjusted by an integral screw and pin 77', the upper end of the pin bearing on arm 77, so that the timing scale will not be depressed by an empty carton but it will be depressed by the carton when it is partly filled, usually to about one-half to three-quarters of its capacity. The arms 73 at their lower ends carry a laterally extending finger

80 which lies between two adjustable stops 81, 82 so as to limit the up and down movements of the platform 34.

A mercury switch 83 is connected to oscillate with the short arms 76. It will be noted that because of the shortness of the links 75, they will oscillate through a much greater arc than do the links 74 with the same vertical movement of the scale platform 34. Thus, a very slight movement of the platform is sufficient to tilt the mercury switch 83 so as to close the contacts. The wires 84, 85 from the mercury switch are connected to a source of power to energize a solenoid 86 (Figs. 1, 2 and 12).

The solenoid 86 has an armature 87 which is connected to one end of a pivoted latch 88 that engages and normally prevents rotation of the clutch element 69 that is fixed to the shaft 68. When the weight of a carton 30 is sufficient to depress the scale platform 34 and tilt the mercury switch 83, the solenoid 86 is energized and releases the latch 88 from the clutch. This causes the shaft 68 to make one complete revolution when it will again be brought to rest by reason of the clutch element 69 re-engaging the latch 88 at the end of the revolution.

Referring to Figs. 7 and 8, the liner 31 of the carton as it comes from the forming machine and is delivered to the belt 35 is or may be bowed in on its two sides as indicated at 89, 90 in Fig. 7. The function of the spreader fingers 32, 33 is to press back the bowed sides of the liner against the sides of the carton while it is being filled. We preferably use three fingers 33 on one side of the carton which are staggered with respect to two fingers 32 that are used on the opposite side of the carton. The three fingers 33 are fixed to an oscillating shaft 91 which has a short arm 92 connected to one end of a link 93, the opposite end of which is connected to a longer arm 94 fixed to a shaft 95 carrying the two fingers 32. Either the shaft 95 may carry a short arm or one of the fingers 32 may have a short extension 96 to which the upper end of a link 97 is connected. As shown in Figs. 6 and 7, vertical reciprocating motion of the link 97 will oscillate the shaft 95, carrying the fingers 32 with it and through the crank arms 94, 92 and link 93 will oscillate the shaft 91 carrying the fingers 33.

Usually the liner for the carton has a seam or lap on one side as 89 and that side bows inwardly less than the side 90. The side 90 at times may bow in so far that it would be struck by the center finger 33 if the finger 33 came down into the carton before the bowed side 90 were out of the way. By having the crank 94 longer than the crank 92 and slightly in advance thereof, the fingers 32 will enter within the liner and press the bowed side back far enough so that it cannot be struck by the center finger 33 before any of the fingers 33 get down into the top of the liner. Then as the shaft 95 continues to oscillate due to the continued upward stroke of the link 97, the speed of oscillation of the shaft 91 will increase so that the fingers 33 will speed up and be fully down inside the liner and holding the side 89 back in position by the time that the fingers 32 are fully down.

Referring now to Figs. 11 and 12, the link 97 is connected at its lower end to an arm 98 which is pivoted at 99 to the frame of the machine and at its opposite end 100 is connected to a spring 101. Intermediate its point of support 99 and the link 97, the lever 98 carries a roller 102 which is adapted to engage in a groove in the cam 70 that is keyed to the shaft 68. When the roller 102 is in the cam groove as shown in Fig. 11 the spring 101 pulls down on the end 100 of the lever which raises the link 97 and causes the fingers 32, 33 to be turned down inside and open the carton liner. When the roller 102 is riding on the rise or concentric part of the cam 70 the link 97 is pulled down and the fingers 32, 33 are raised out of the carton to their highest dotted line position as shown in Fig. 8. When the fingers are in this retracted position a filled carton can be removed from the platform 34 and an empty carton positioned thereon ready to be filled with crackers. The roller 102 engages in the recess in the cam 70 when the shaft 68 is at rest and the groove in the cam is relatively deep so that the roller 102 operates to locate accurately the driven part 69 of the one-revolution clutch when it has completed its revolution. This groove and roller 102 take the place of a brake to hold the clutch at the point of disengagement and prevents chattering which would occur otherwise without a brake.

When the string of cartons is approaching the timing scale from the left as in Fig. 11 it is necessary to locate the carton 30 that is to be filled accurately on the timing scale and since the belt 35 is driven continuously and is carrying a long string of empty cartons, it is necessary to prevent this string of cartons from pressing against the side of the carton that is being filled. If there were any considerable pressure against the side of the carton 30, it would tend to hold up the carton and prevent its weight from being exerted or measured accurately upon the timing scale platform 34.

In order to position the carton 30 accurately and to prevent side pressure against it from the on-coming string of empty cartons, we provide two stop fingers 36, 37 the first of which engages the forward or advance side of the carton that is to be filled and accurately locates it upon the timing scale. The other finger 37 passes between two following cartons and holds back the string of cartons on the belt 35 so that they cannot press against the carton 30 (see Fig. 11).

As shown in Figs. 9 and 12 the stop fingers 36, 37 are made from relatively thin metal and are pivotally mounted at 103, 104 on the frame of the machine and springs 105 (Fig. 9) tend to press the fingers 36, 37 of the stops inward so that they project into the line or path of travel of the cartons. Each of the stops has a U-shaped recess as shown in Fig. 9 which loosely embraces a roller 106, 107 carried by arms 108, 109 keyed to a rock shaft 110 mounted in bearings on the frame of the machine. The shaft 110 carries a rocker arm 111 to which one end of a vertical link 112 is connected. The lower end of the link is connected to an arm 113 that is keyed to a shaft 114 the opposite end of which carries another arm 115 connected at its free end to push-rod 116 which at its opposite end has a fork 117 fitting over the shaft 68 and a roller or follower 118 that rides upon the cam 71.

The shaft 119 which carries the pulley 41 also carries a sprocket 120 driving a chain 121 that engages a sprocket 122 keyed to a shaft 123 that is mounted in bearings on a swinging frame 124 supported by bearings 125, 126 on the shaft 119. The shaft 123 extends to one side of the swinging frame and has the accelerating roller 72 fixed to it. The timing scale platform 34 has an opening 127 which normally is directly over the roller 72 but when the carton on the scale is filled the rotating roller is swung up through

the opening so that it engages the bottom of the filling carton and accelerates its movement from the scale.

The accelerating roller is moved into and out of contact with the bottom of the carton through its connection with the shaft 114, the movement of which is controlled by the cam 71. As best shown in Figs. 2 and 11, the shaft 114 has an arm 128 to the outer end of which the lower end of the link 129 is connected. The upper end of this link is connected to the swinging frame 124. As the shaft 114 is oscillated so as to rock the shaft 110 and withdraw the stops 36, 37, it also swings the frame 124 upward until the roller 72 contacts the bottom of the filled carton as shown in dotted lines in Fig. 11.

Referring now to Fig. 11, the cams 70 and 71 rotate counter-clockwise. The roller 118 on the push-rod 116 is in engagement with the high part of the cam which embraces about 270° and is concentric with the axis of rotation so that when the roller 118 is riding on this high part of the cam there will be no movement of the shaft 114 and its connected parts. The cam also has a short concentric part 130 which embraces about 75° and is lower than the high part of the cam. The active part of the cam consists of a short drop 131 and a similar short rise 132. As the cam rotates counter-clockwise and the roller or follower 118 rides down the short decline 131, the spring 133 pulls the follower in toward the low concentric portion 130 and rocks the shaft 114 clockwise. This movement withdraws the stops 36, 37 and raises the roller 72 into contact with the bottom of the carton. This operation is timed so that the fingers are withdrawn and the roller brought into contact with the bottom of the carton at just about the instant that the carton 30 has received its full quantity of crackers. When the shaft 68 has rotated about one quarter of a revolution the roller 118 rides up on the rise 132 which rocks the shaft 114 back to its original position withdrawing the roller 72 and releasing the stops 36, 37 which are then free to be pressed inward by the springs 105 to engage the next cartons. The time that the roller 118 is in contact with the low part of the cam 130 is less than it takes for the filled carton to move entirely off from the scale platform so that when the stops 36, 37 are released, the springs bring them back into contact with the sides of the cartons. They are then in position to enter between two cartons as soon as the edges of the cartons that they are contacting come up to the stops.

In order that the stops may enter between adjacent cartons with certainty, we provide means for moving the carton which is on the scale platform and the next adjacent carton slightly out of line with the empty cartons on the left hand end of the belt 35 and the filled cartons on the right hand end of the same belt.

Referring now to Fig. 1, we provide a wedge-shaped member or deflector 134 at one side of the belt 35 so that as the cartons pass it, the deflector causes the advancing edge of one carton to move laterally out of alignment. This is the second carton marked 30B, Fig. 11, and its being angled in this manner causes a gap 135 to be opened between it and the next forward carton 30A into which gap the finger 37 will be snapped by the spring as it slides off of the edge of the carton 30A (see Fig. 11). The guide rails 163, 164 at the two sides of belt 35 converge slightly at the timing scale (Figs. 1 and 12), and beyond the scale, the rail 165 is substantially in alignment with rail 164 while rail 166 is offset at 167. As the filled carton is leaving the platform and riding on to the moving belt 35 at the right (Fig. 11), the offset 167 will permit pressure of the finger 36 against the carton 30 to move it laterally away from the finger and out of alignment with the following carton 30A so that when the forward edge of the carton 30A comes into position on the platform 34 the finger 36 will be in far enough to engage and stop it. The finger 36 is located so that when the forward face of the carton contacts it, the carton will be properly located beneath the filling chute 29 and in position so that the liner spreading fingers 32, 33 can enter the top and hold the liner. The space between the stops 36, 27 is slightly greater than the width of two cartons so that there is no side pressure on the carton 30 while it is being filled except the very slight pressure due to the carton 30A which is not greater than the sensitiveness of the timing scale 34.

Our filling and weighing machine is capable of very rapid operation, its capacity being 30 or more one-pound cartons per minute. The volume of material handled is considerable and it must be supplied rapidly and uniformly in order for the machine to function properly. In case of a mal-function in any part of the machine, the crackers or other material being packaged will continue to be supplied and within a few seconds will cause a considerable pile up of material. Also the crackers must flow uniformly from the weighing scale into the cartons and not be dumped in in one large bunch or group. Therefore, it is necessary that the filling chute be designed to cooperate with the weighing scale to cause the crackers or other material to flow along it in a uniform stream to the carton that is being filled. In the event of a mal-function or stopping of the filling mechanism for any purpose, we have provided a by-pass by means of which the material coming to the delivery chute 21 can be by-passed until the trouble has been remedied.

Referring again to Figs. 3 to 6, the crackers coming in on the belt 20 pass over the by-pass gate 22 which is secured to a shaft 137 which extends across the delivery chute 21 and is supported to oscillate in bearings 138, 139. At one end the shaft 137 carries an arm 140 (Fig. 6) which is adapted to engage either of two adjustable stops 141, 142 to limit movement of the gate 22 in both directions.

At its opposite end the shaft 137 carries a crank arm 143 which is connected to the upper end of a link 144, the lower end of which is connected to operating crank or lever 145 which is adjacent the lower end of the filling chute 29 where it may be easily reached by the operator or attendant of the machine. When the operator notes any trouble with the machine or that the delivery chute or weighing scale or filling chute has become clogged, he will rock the lever 145 so as to raise the by-pass gate 22 to the dotted line position shown in Fig. 5. This opens up a direct passage to the by-pass chute 146 through which the crackers or other articles will flow into suitable containers until the difficulty has been remedied. Since the machine attendant may not always be close to the lever 145 in case of trouble, we have provided a remote control for the by-pass gate which is operated electrically from any convenient point as from the check-weigher's station 168 (Figs. 1 and 2). As shown in Fig. 6, a latch

plate 147 is mounted loosely on the shaft 137 and has a laterally extended lug 148 which engages under the arm 143. The latch plate also has a lip 149 that is engaged by a pivoted latch 150 which normally prevents rotation of the latch plate. The latch plate has a pin 151 to which one end of a spring 152 is connected. The tension of this spring tends to rotate the latch plate counter-clockwise (Fig. 5) and holds the lip 149 against the latch 150. The latch 150 is connected by a short link to the armature 153 of a solenoid 154 which is controlled by a push button or switch located at any convenient place as at the station where the check-weigher is located. If the check-weigher notices any difficulty in the operation of the machine, he will press the switch closing the circuit to the solenoid 154, which will lift the latch 150 and the spring 152 will throw the by-pass gate over to the dotted line position shown in Fig. 5. The operation of the switch and solenoid is much quicker than manual operation of the lever 145 and usually will be relied upon for control of the by-pass.

A spring 155 similar to the spring 152 is connected to a pin 156 on the lever 140 and normally holds the lever down so that the arm 140 is in contact with the stop 141. When the arm 140 engages the stop 141, the by-pass gate 22 is in full line position as shown in Fig. 5. It will be noted that the center line of the spring 155 passes below the axis of the shaft 137 (Fig. 5) and that its pull is counter to the pull of the spring 152 but the spring 152 has a longer effective lever arm and will pull the lever 143 along with it when the latch is released until the center of the spring 155 passes the axis of the shaft, after which both springs 152 and 155 are effective in raising the by-pass gate 22.

In normal operation the crackers supplied to the delivery chute by the belt 20 flow over the by-pass gate 22 and across the screen 23, if the latter is used, where crumbs and fine particles are sifted out. The crackers then flow on to the delivery or distributing plate 24 which causes the crackers to be distributed in a uniform layer or stream as they fall onto one of the vanes of the weighing scale. The weighing scale is of a usual commercial type and has four vanes supported on a shaft which is connected to and supported by one end of the scale beam 157.

The scale moves up and down with varying load as controlled by the adjustable weights on the scale beam 157. A latch 158 is adapted to engage the vane which extends vertically upward and prevents rotation. As shown in Fig. 3, the vane 26 is engaging the latch 158. The delivery or distributing plate 24 is arranged so that the crackers delivered by it will fall on the vane which is then horizontal, the vane 25 being so shown in this figure, so that they will pile up on the vane near the axis or center of rotation and not near the outer edge of the vane. We have found this to be an important feature of the invention and that it contributes materially to the uniform flow of the crackers along the filling chute. The weights on the scale are adjusted so that when a unit quantity of crackers as say, one pound or one-half pound, has fallen onto the vane 25, the scale will descend and the vane 25 will clear the latch 158. The scale starts to rotate and the crackers to slide off the vane 25 into the filling chute 29. It will be remembered that the crackers are piled up on the vane 25 near the center and few, if any, adjacent its delivery edge. As the vane starts to rotate downward the crackers start to slide off it and against the curved rear part 159 of the filling chute. This part of the filling chute 159 is curved so that as the vane swings down the distance between the tip of the vane and the curved wall is continuously increasing. This prevents any jamming of the crackers between the edge of the vane and the wall of the chute and also insures a more uniform distribution. For a short distance a part of the chute 160 is straight and it terminates in a curved portion 161 at the delivery end which preferably takes the form of the path that the crackers would travel if they fell freely after leaving the straight part of the chute at about the point 162. In other words, the curved portion of the chute 161 is such that there is little or no friction of the crackers flowing over it but they enter the carton just as though they were falling freely from the point 162. We have found that the curvature of the filling chute at 159 where its distance from the tip of the vane is constantly increasing and the curvature of the delivery end of the chute so that the crackers fall freely contribute materially to the speed at which the weighing and filling apparatus may be operated and the uniformity at which the material flows.

The belt 35 which carries a continuous line of cartons to the filling station or timing scale travels much faster than the cartons can be filled and taken away. Usually the belt 35 will travel from two to three times as fast as the cartons can be filled. This is so that there will always be an empty carton in position 30A ready to be moved on to the timing scale platform just as soon as the carton 30 thereon is filled. The cam shaft 68 is driven from the shaft 63 which carries one of the driving pulleys 39 and its speed is such that the interval that the roller 118 is traveling from the incline 131 to the incline 132 is less than the time that it takes the carton 30A to travel its full width. The sole timing mechanism is the timing scale 34 and its operation depends upon the rate at which the cartons are filled. The faster the crackers are filled into the carton 30 the more frequently the mercury switch 83 will be tripped and the operating mechanism actuated. The tension of the spring 78 against which the timing scale operates is selected so that the timing scale will move down far enough to close the mercury switch when it has been filled to about one-half or a little more of its capacity. Thus, if the cartons being filled are one pound cartons, the switch will be closed when a little more than one-half pound of crackers are in the carton 30 and the remainder of the pound is still flowing down the filling chute 29. It will thus be seen that the operating mechanism is set in operation before the carton is entirely filled and the carton which is being filled is itself the means which times its own removal. This machine operates very rapidly, weighing and filling up to 30 or more packages per minute so that it is necessary that the means for removing the carton and bringing in an empty carton be set in operation before the carton is completely filled because there is necessarily a slight lag or delay between the time that the mercury switch is closed and when the cams 70 and 71 start to function. Thus, if the switch 83 is closed when the carton is about one-half full, the rest of the unit quantity of crackers will have been received in the carton by the time that the clutch 67 has been engaged and started to revolve the shaft 68. As soon as the shaft 68 starts to turn, it depresses the roller 102 which through the link 97 raises the spreader

fingers 32, 33 out of the carton to the highest dotted line position shown in Fig. 8. Continued rotation of the shaft next withdraws the stops 36, 37 and simultaneously therewith moves the accelerator roller 72 against the bottom of the filled carton. Usually when there is a long string of empty cartons on the conveyor 35 which may be 25 feet or longer there is sufficient pressure exerted by these cartons against the filled carton after the stops 36, 37 have been withdrawn so that movement of the filled carton toward the right-hand side of the belt 35 has started before the accelerator roller 72 comes into operation. However, when the line of cartons on the belt 35 is short or when the end of the run approaches so that nearly all of the cartons have been used up, their pressure is insufficient to shove the filled carton along, at least it will not be shoved along quickly enough. In that case the accelerator roller comes into operation to remove the filled carton quickly and to enable the entire line of cartons on the belt 35 to be moved in and filled.

The belt 20 carrying the crackers to the delivery chute 21 is operated at such a speed that it will normally fill and operate the weighing scale about 30 times per minute. This means that about once every two seconds a unit quantity of crackers will be started down the chute 29. There must be a carton 38 in position on the weighing scale to receive these crackers whenever they come down. Therefore, in order to take advantage of the maximum speed at which the weighing scale may operate, the means for feeding, positioning and removing the cartons from the timing scale must operate within less time than it takes to supply a unit quantity of crackers to the weighing scale. By having the mechanism for controlling the cartons set in operation before the carton is completely filled, a much faster operation can be attained because there need be no delay between the filling of the carton and its removal.

In some cases as when the line of empty cartons on the belt 35 is long enough, or the filled cartons are light enough so that they can be accelerated rapidly, or the speed of operation is relatively slow, the accelerator roller 72 may be dispensed with. But usually the operation will be faster and more certain with the roller in use.

We have shown the belt 35 as continuous on both sides of the timing scale, but this illustrates only one form of conveyor that may be used and the invention is not limited thereto. When we use the term belt or conveyor it will be understood to mean either a one piece belt, as illustrated, or other equivalent means to perform the same function.

While we have shown but one form of our invention and have used specific terms in describing and claiming it, it is to be understood that this is for purposes of illustration only and not as limitations on the invention. We claim all modifications and adaptations thereof that may come within the scope of the following claims and equivalents thereof.

What we claim is:

1. In a weighing and filling machine, the combination of a filling chute, means for intermittently discharging unit quantities of material to the chute, means for positioning an empty lined carton beneath the chute to receive a unit quantity of material therefrom, and spreaders adjacent two opposite sides of the lower end of the chute for spreading and holding open the top of the liner while the material is entering the carton, cranks of different lengths connected to operate the spreaders on the respective sides, the longer crank being in advance of the shorter one, a link connecting said cranks, means for oscillating said cranks to cause said spreaders to enter and withdraw from the top of the carton, the relative angularity of the cranks being such that the spreaders on the side actuated by the long crank enter the top of the carton ahead of the spreaders on the other side.

2. In a weighing and filling machine, the combination of a filling chute, means for intermittently supplying unit quantities of material to the chute, a timing scale beneath the delivery end of the chute, feeding means for supplying empty cartons to the timing scale, means for positioning an empty carton on the scale to receive material from the chute, the chute being formed to deliver a unit quantity of material in a uniform stream to the carton, means for removing the carton when it has received a unit quantity of material, control means for said positioning means and removing means, and means set in operation by the timing scale when the carton has received a part only of a unit quantity to actuate said control means independently of said supplying means.

3. In a filling machine, the combination of a timing scale, a continuously driven belt for carrying a line of empty cartons to said scale, a pair of yieldably mounted fingers normally projecting into the path of travel of the cartons, one finger being arranged to engage the forward side of a carton on the scale, the other finger being arranged to engage the forward side of a following carton on the belt and relieve the carton on the scale from pressure of the cartons on the belt, means for withdrawing the fingers against the tension of the yieldable means when the carton on the scale has been filled whereby the cartons are moved forward by the belt, said fingers being released when the cartons have been moved less than their width whereby the fingers re-engage the cartons on their sides and engage the forward sides of the next following cartons as they come into registry therewith, and means for separating the edges of the cartons that are engaged on their sides by the fingers from the next following cartons whereby the fingers may enter therebetween.

4. In a filling machine, the combination of a timing scale, a continuously moving belt for supplying a line of empty cartons thereto, a pair of stops movable into and out of the path of travel of the cartons, one of said stops being adapted to engage the forward side of a carton and position it on the scale, the other of said stops being adapted to engage the forward side of a following carton and hold the line of cartons from pressing against the carton on the scale, means for weighing a quantity of material to fill a carton when it has been positioned on the scale by said stop, means for dumping into the carton said quantity as soon as it is weighed, spreaders for holding the top of the carton open while it is being filled, operating means for said stops and spreaders, and control means for said operating means that is set in operation by movement of said scale by a carton thereon while it is being filled, whereby the slack in the operating means will be taken up by the time the carton has received the entire weighed quantity.

5. In a weighing and filling machine, the combination of a filling chute, a weighing scale adapted and arranged to weigh and deliver unit

quantities of material in succession to the upper end of said filling chute, a timing scale, a continuously driven belt carrying a line of empty cartons to said timing scale, a front stop for engaging the forward side of a carton to position it on said timing scale below the delivery end of said filling chute, a second stop for engaging the forward side of a following carton on the belt to prevent pressure of the line of empty cartons against the carton on the timing scale, means for opening gaps between edges of the respective cartons to be engaged by said stops and the next preceding carton to provide entrances for said stops, spreader fingers mounted adjacent the delivery end of the filling chute adapted to hold open the top of the carton on the timing scale, a cam shaft having cams for operating said preader fingers and stops, a one-revolution clutch for driving said cam shaft, and means controlled by movement of said timing scale when the carton thereon has received less than the unit quantity of material from the filling chute, to cause said clutch to engage and rotate said cam shaft, whereby the slack will be taken up, rotation of the cam shaft started, and the spreader fingers and stops moved to inoperative position by the time that the carton has received its full quantity, said control means being mechanically independent of said weighing scale.

6. In a weighing and filling machine, the combination of a filling chute, a weighing scale adapted and arranged to weigh and deliver unit quantities of material in succession to the upper end of said filling chute, a timing scale, a continuously driven belt carrying a line of empty cartons to said timing scale, a front stop for engaging the forward side of a carton to position it on said timing scale below the delivery end of said filling chute, a second stop for engaging the forward side of a following carton on the belt to prevent pressure of the line of empty cartons against the carton on the timing scale, means for opening gaps between edges of the respective cartons to be engaged by said stops and the next preceding carton to provide entrances for said stops, spreader fingers mounted adjacent the delivery end of the filling chute adapted to hold open the top of the carton on the timing scale, a cam shaft having cams for operating said spreader fingers and stops, a one-revolution clutch for driving said cam shaft, and means controlled by movement of said timing scale when the carton thereon has received less than the unit quantity of material from the filling chute, to cause said clutch to engage and rotate said cam shaft, whereby the slack will be taken up, rotation of the cam shaft begun and the spreader fingers moved out of the carton when the full quantity has been received therein, said control means being independent of said weighing scale, said cams being arranged to withdraw the spreader fingers from the carton before the stops are retracted from holding position.

7. In a filling machine, the combination of a filling chute, means for placing an empty lined carton beneath the chute to receive material therefrom, a pair of oscillatable shafts mounted adjacent opposite sides of the filling chute and being on opposite sides of the carton to be filled, a plurality of fingers secured to each shaft, said fingers when horizontal extending toward each other between said shafts and above the carton liner, means for oscillating said shafts simultaneously to turn the fingers down into the carton liner and press it against the sides of the carton, said oscillating means comprising cranks of different lengths connected on the respective shafts and a link connecting said cranks, whereby oscillation of the shafts causes the fingers on the shaft having the longer crank to enter and press back one side of the liner before the fingers on the other shaft engage and press back the opposite side of the liner.

8. In a weighing and filling machine, the combination of a filling chute, a weighing scale adapted and arranged to weigh and deliver definite unit quantities of material to the upper end of the filling chute, a timing scale, a continuously operating means for supplying a line of empty cartons to and removing filled cartons from the timing scale, means for positioning the leading empty carton of said line on the timing scale to receive a unit quantity of material from the lower end of the chute, and control means for the positioning means set in operation by the timing scale while the unit quantity is flowing from the chute into the carton thereon, whereby the control means will start to function before the carton is filled and the positioning means and feeding means will be in operation to remove the filled carton and position the following empty carton as soon as the first carton has received its entire unit quantity, said feeding means, positioning means and control means being mechanically independent of but functionally dependent on said weighing scale and delivery chute.

9. In a filling and weighing machine, the combination of a timing scale, a continuously driven belt for supplying a line of empty cartons to said timing scale, stop means for positioning the leading carton of the line on the timing scale and for preventing pressure of the line of cartons against the carton on the timing scale, a filling chute positioned to deliver material into the carton on the timing scale, a weighing scale positioned to deliver definite amounts of the material periodically to said filling chute, a conveyor delivering material continuously to said weighing scale, said weighing scale being independently operable by the material received by it to deliver to said filling chute a definite amount of the material as soon as it is received from the conveyor, a cam for withdrawing said stop means from the carton on the timing scale, a one-revolution clutch for driving said cam, means actuated by movement of said timing scale when the carton thereon has received less than said definite amount of material to engage said clutch and start rotation of said cam while material is still flowing down said filling chute, the speed of rotation of the clutch being such that the clutch and cam make one complete revolution and come to rest in less time than the conveyor can supply a definite quantity of material to the weighing scale, and the speed of the belt being such that a filled carton will be removed from the timing scale and an empty carton positioned thereon in less time than said clutch and cam make one revolution, whereby the rate of filling the cartons is controlled by the rate at which material is supplied to the weighing scale yet is mechanically independent thereof.

10. In a filling machine, the combination of a timing scale, means for feeding empty cartons successively to the scale, means for positioning the empty carton on the scale, independently operated means for measuring a unit quantity of

material and delivering it by gravity to fill the carton, means for removing the filled carton from the scale, and means set in operation by movement of the scale while the material is falling into the carton to cause the feeding means, positioning means and removing means to start their movements and take up the lag therein by the time that the carton has received the full unit quantity of material.

11. In a filling machine, the combination of a timing scale, a continuously driven belt for carrying a line of empty cartons to said scale, means adjacent the scale for deflecting each carton laterally from the line as it is delivered to the scale, resilient stop means engaging the side of the deflected carton, means for filling each carton while on the scale, means for removing the cartons from the scale as they are filled, means for deflecting each filled carton laterally as it leaves the scale, resilient positioning means engaging the side of the deflected filled carton, said positioning means engaging the forward side of the following carton on the scale to position it thereon as the deflected filled carton is carried beyond it, said stop means engaging the forward side of the following empty carton when the deflected empty carton has been carried beyond it, and means for simultaneously withdrawing said stop and positioning means when the carton positioned on the timing scale has been filled.

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