Nov. 8, 1966 D. E. BURT 3,283,952

DISPENSING APPARATUS

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Fig. 1.

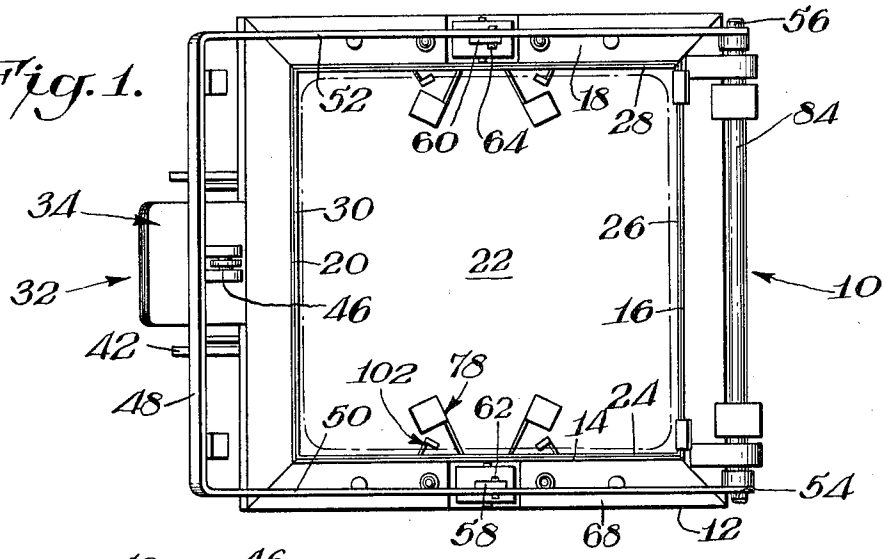
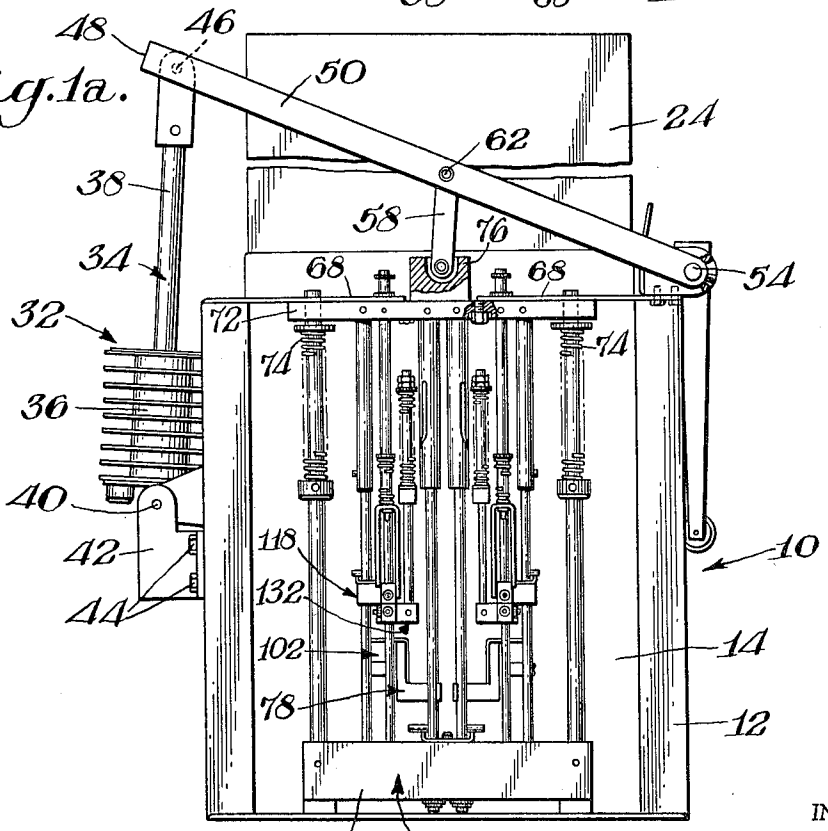


Fig. 1a.



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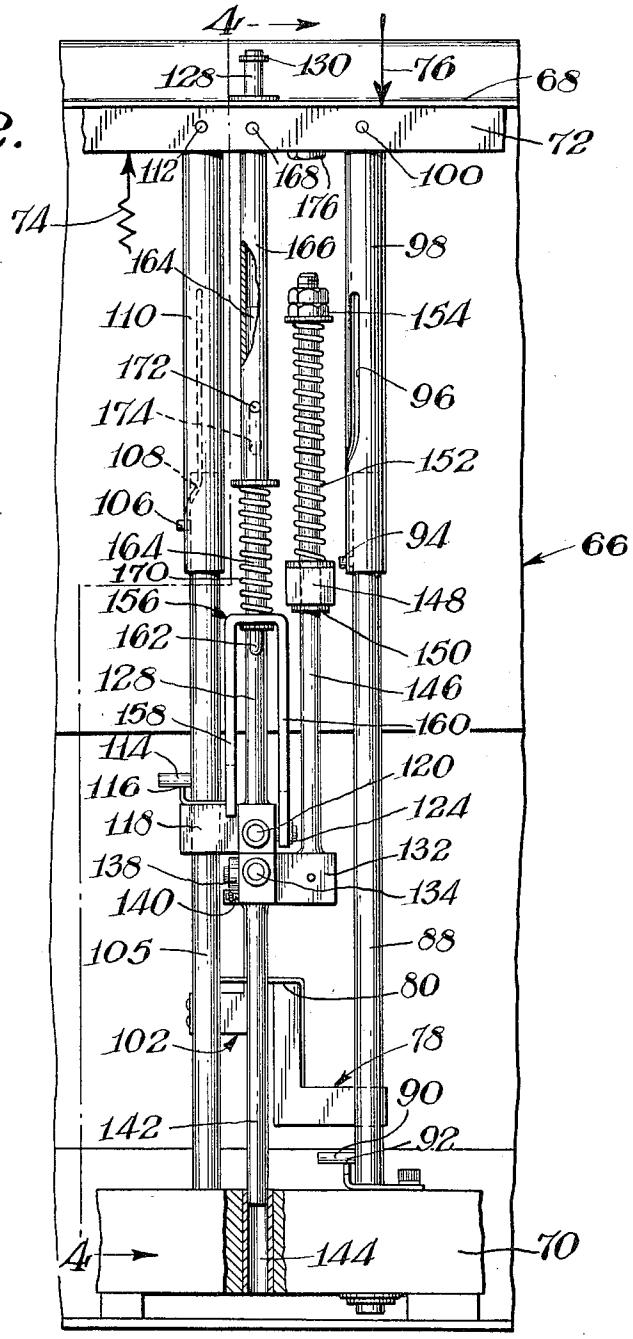
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Fig. 2.



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Fig. 9.

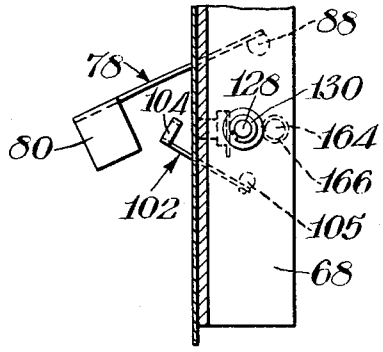


Fig. 10.

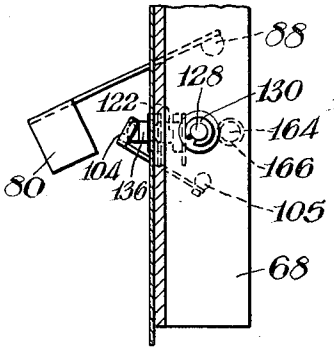


Fig. 11.

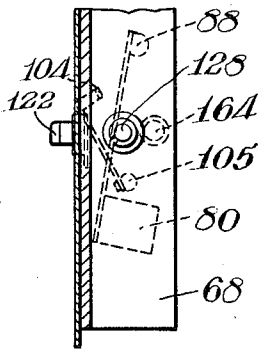
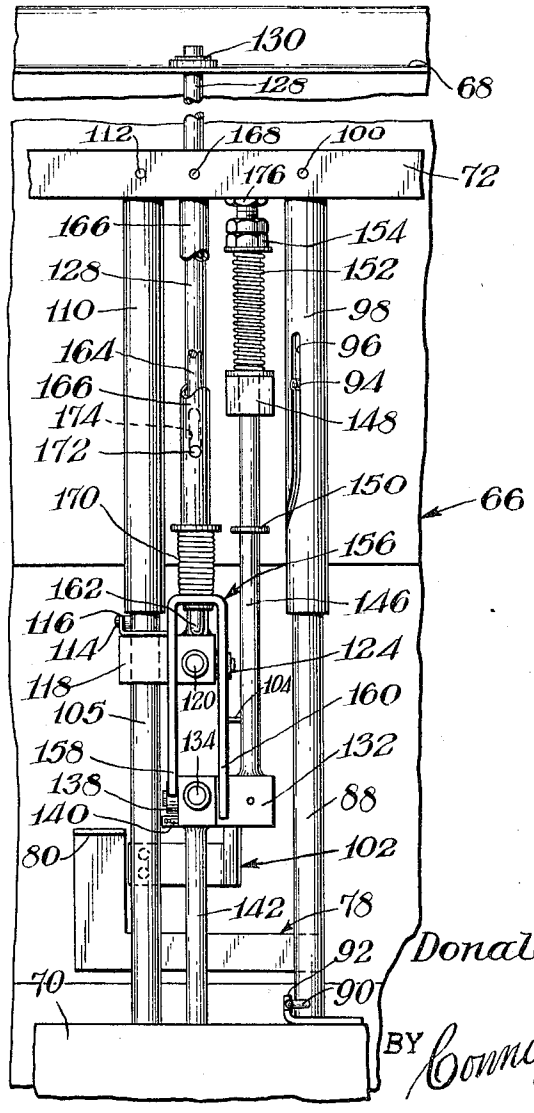


Fig. 3.



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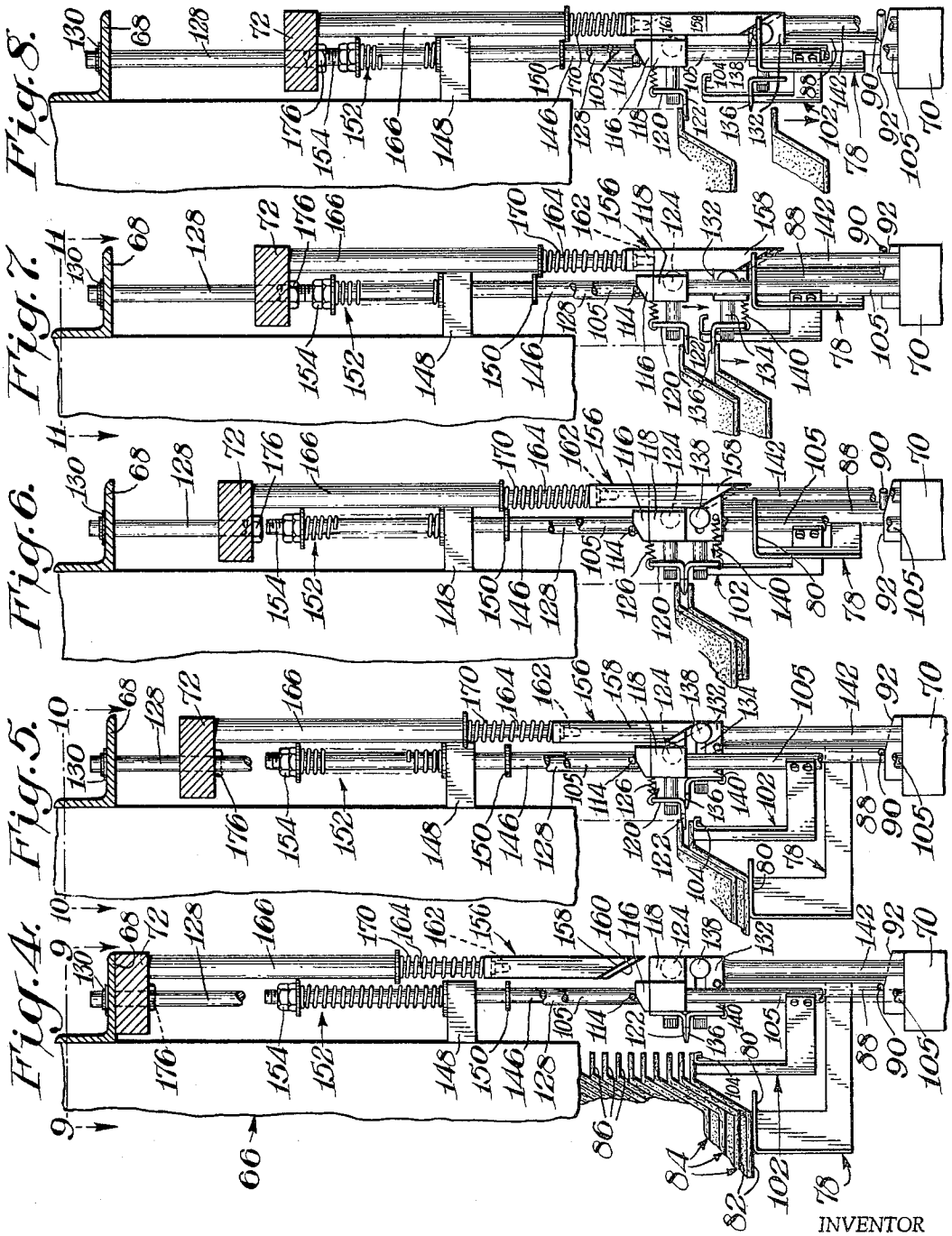
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INVENTOR

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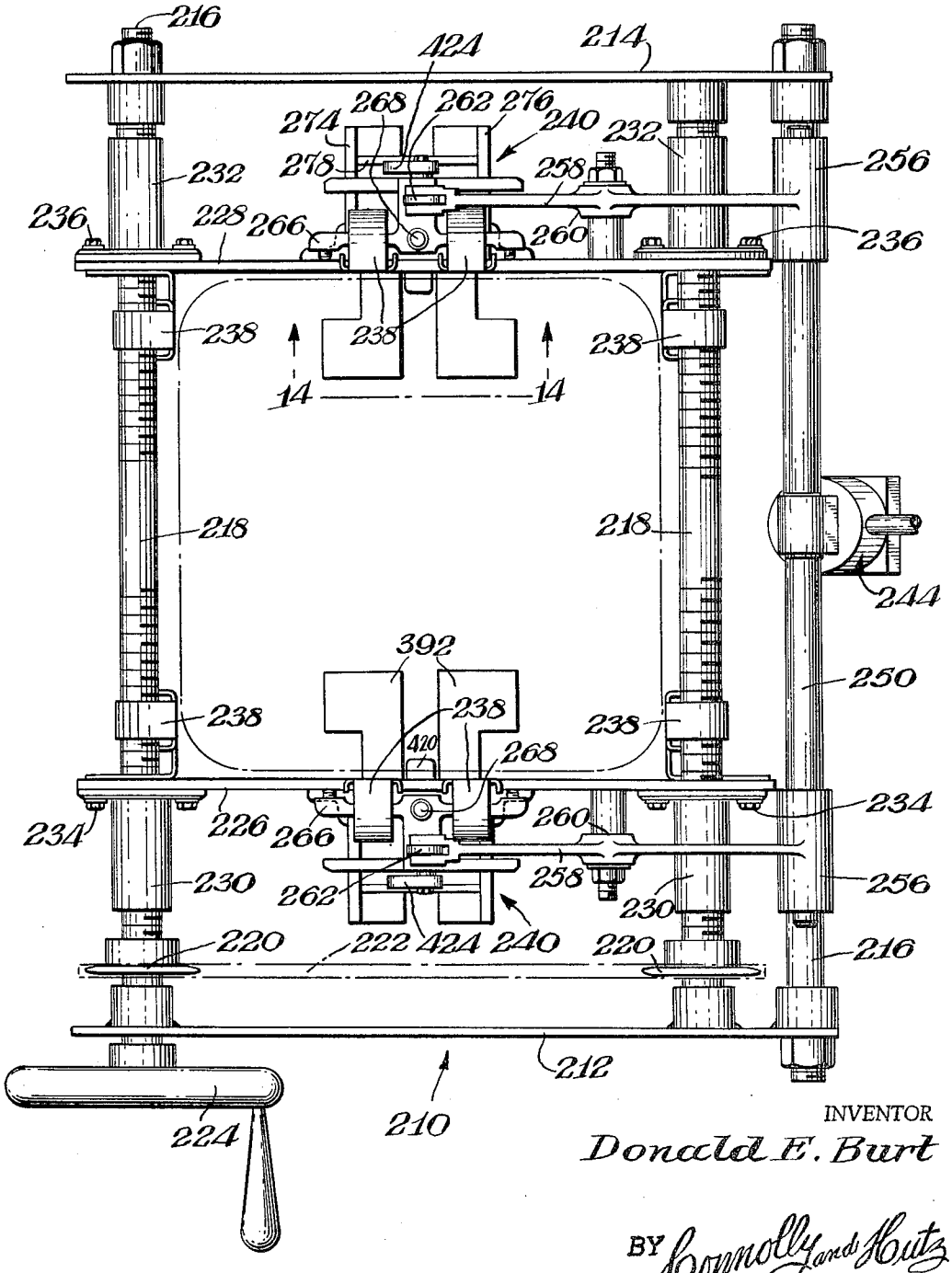
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Fig. 12.



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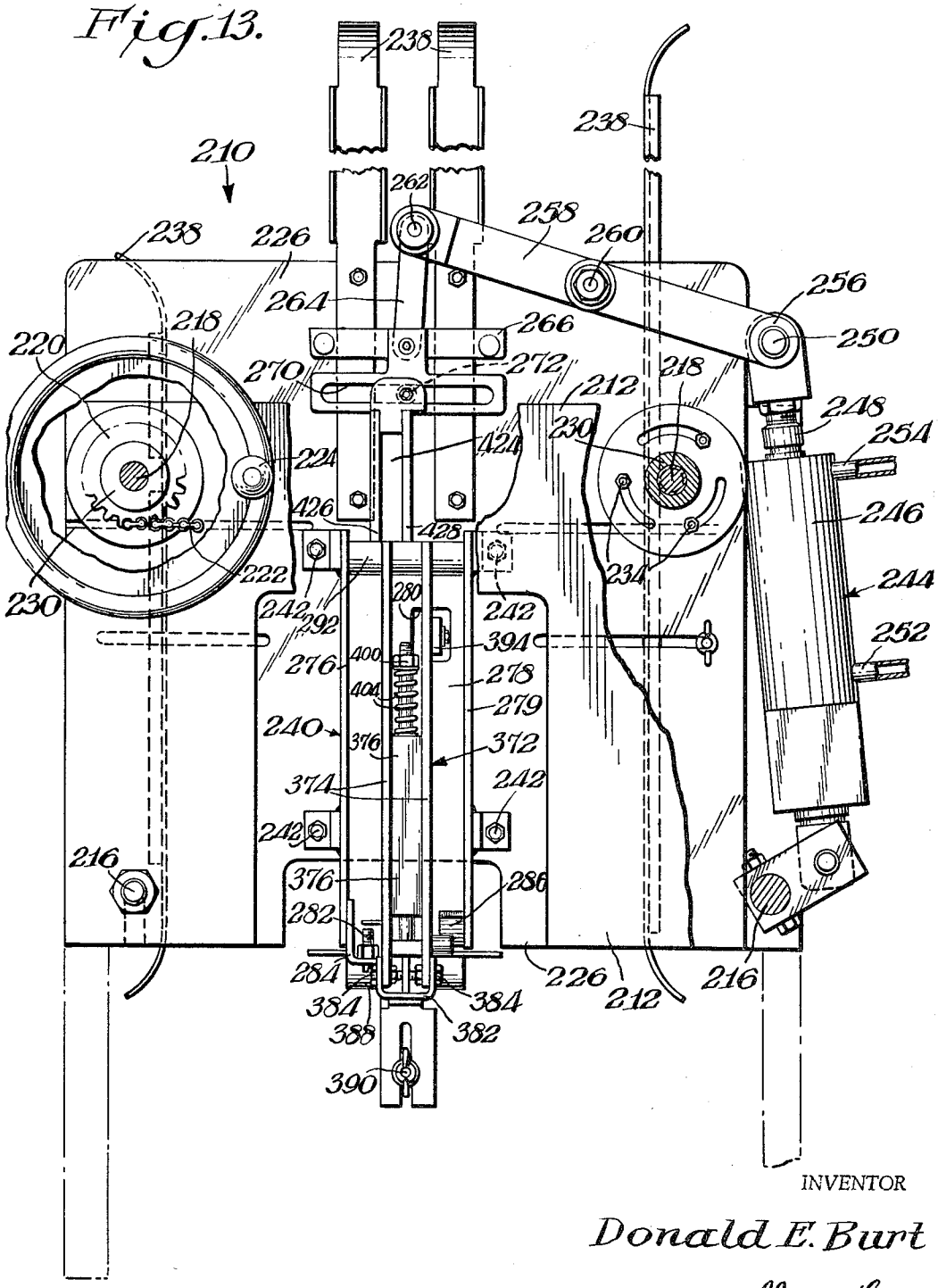
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Fig. 13.



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Fig. 14.

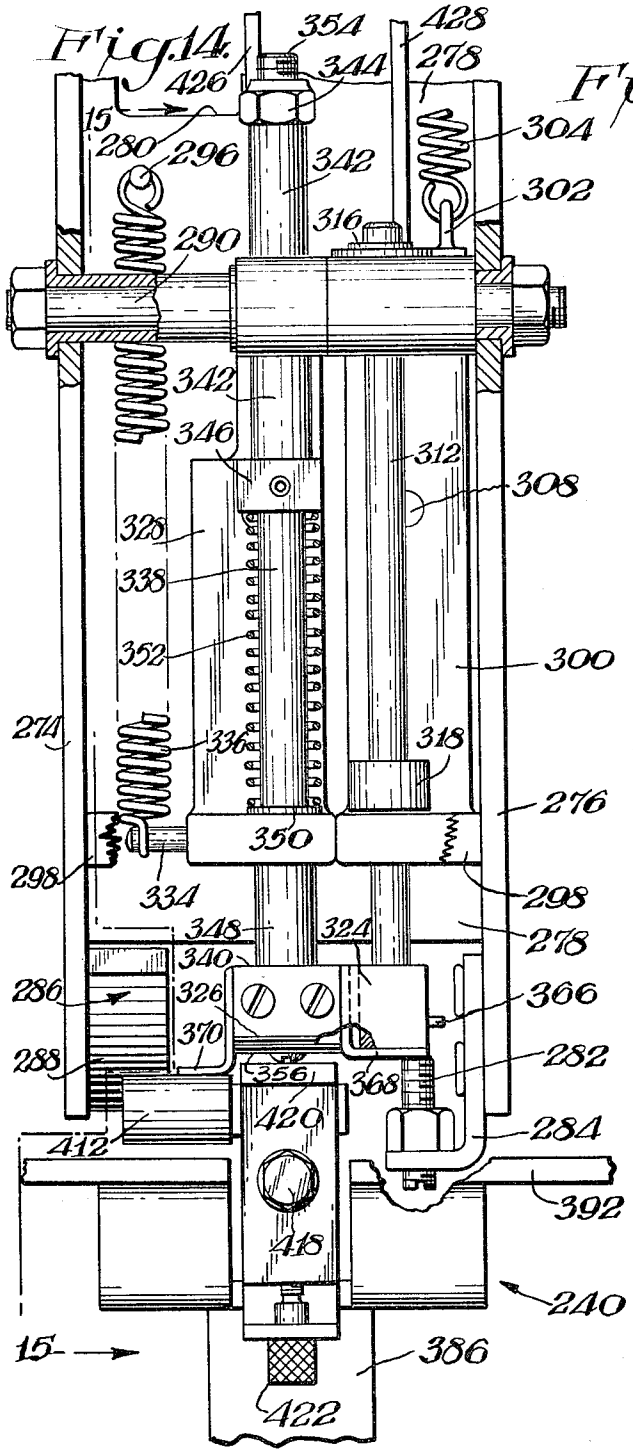
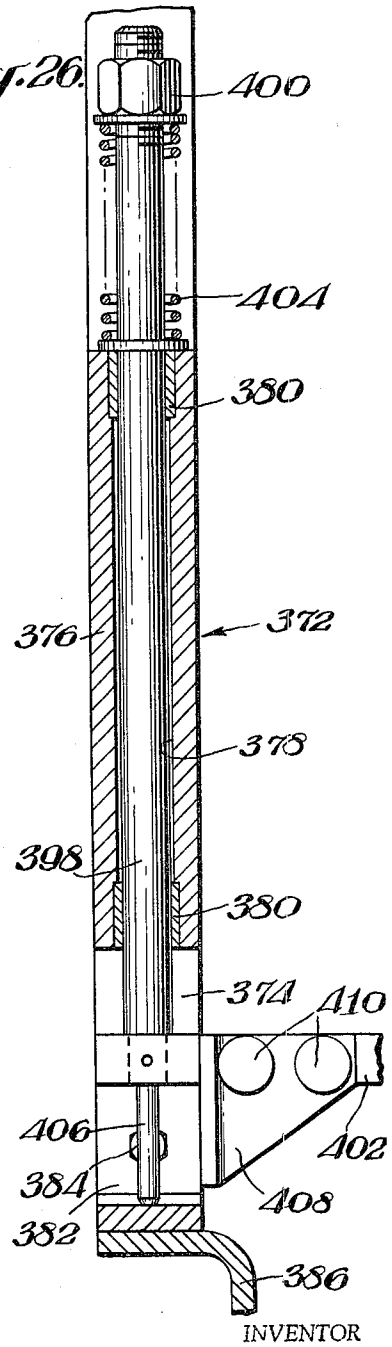


Fig. 26.



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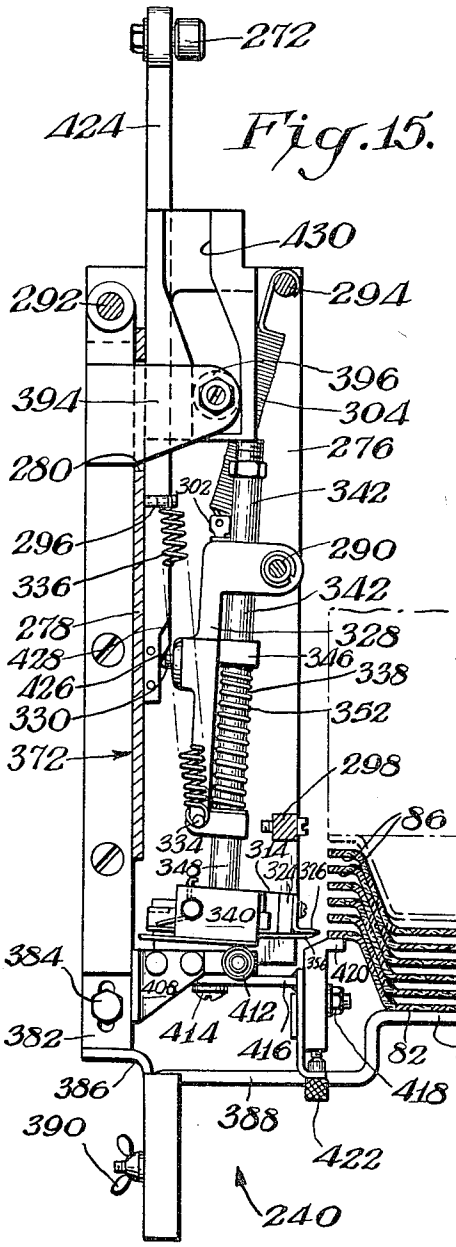


Fig. 15.

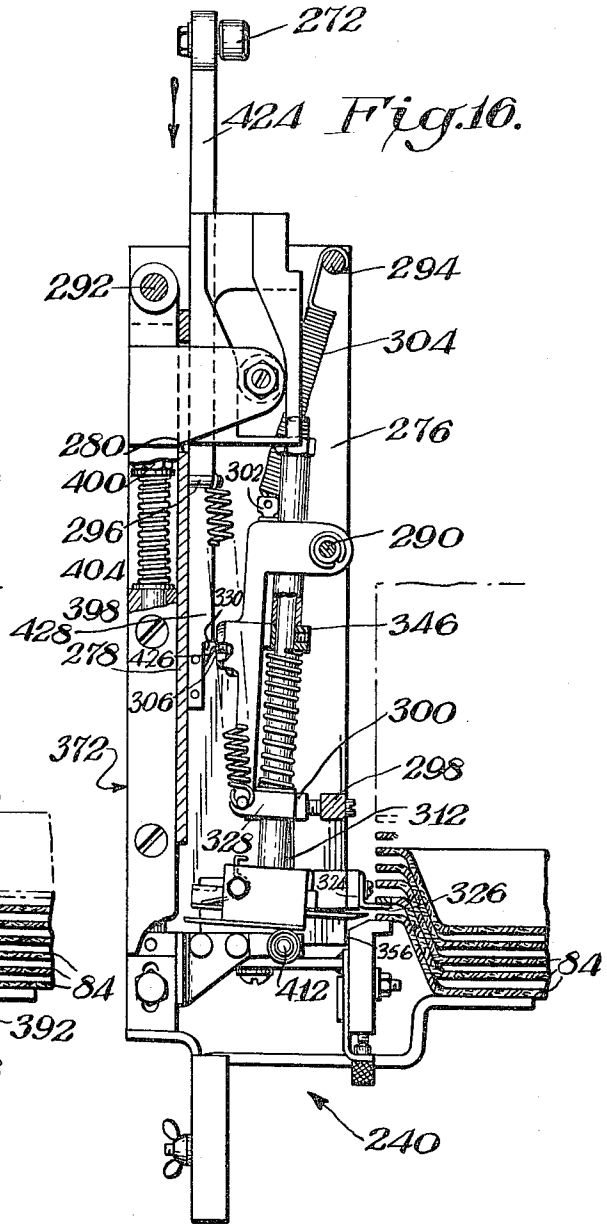


Fig. 16.

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Nov. 8, 1966 D. E. BURT 3,283,952

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Fig. 17.

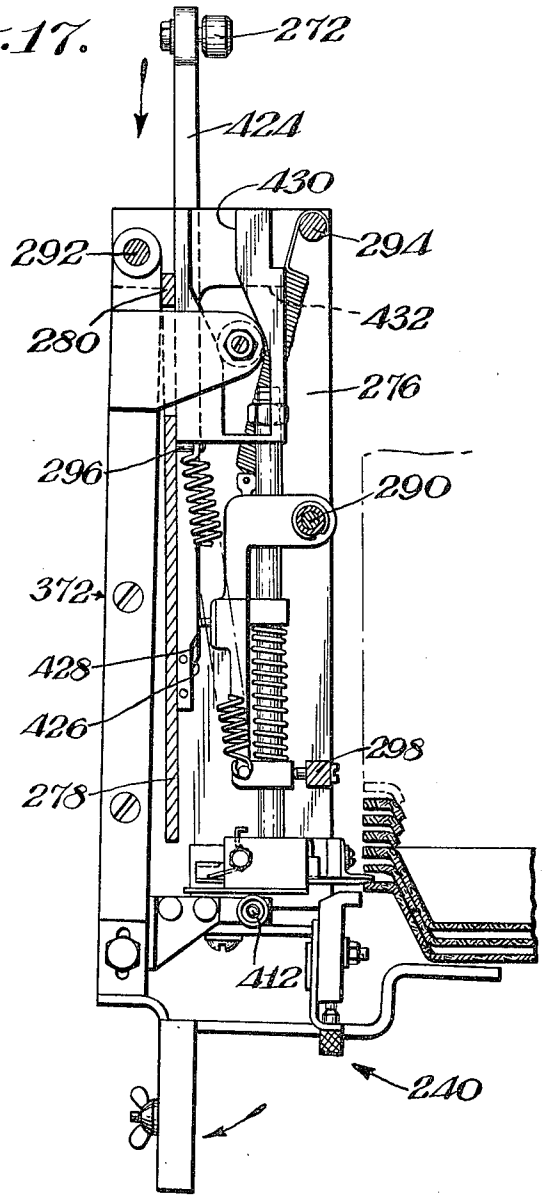
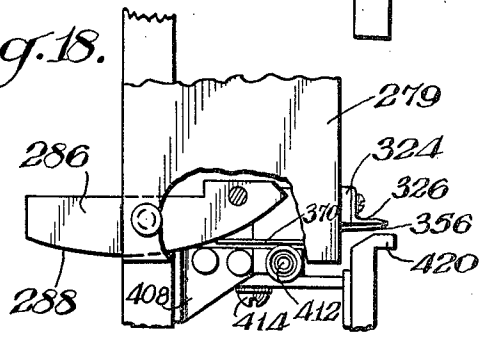


Fig. 18.



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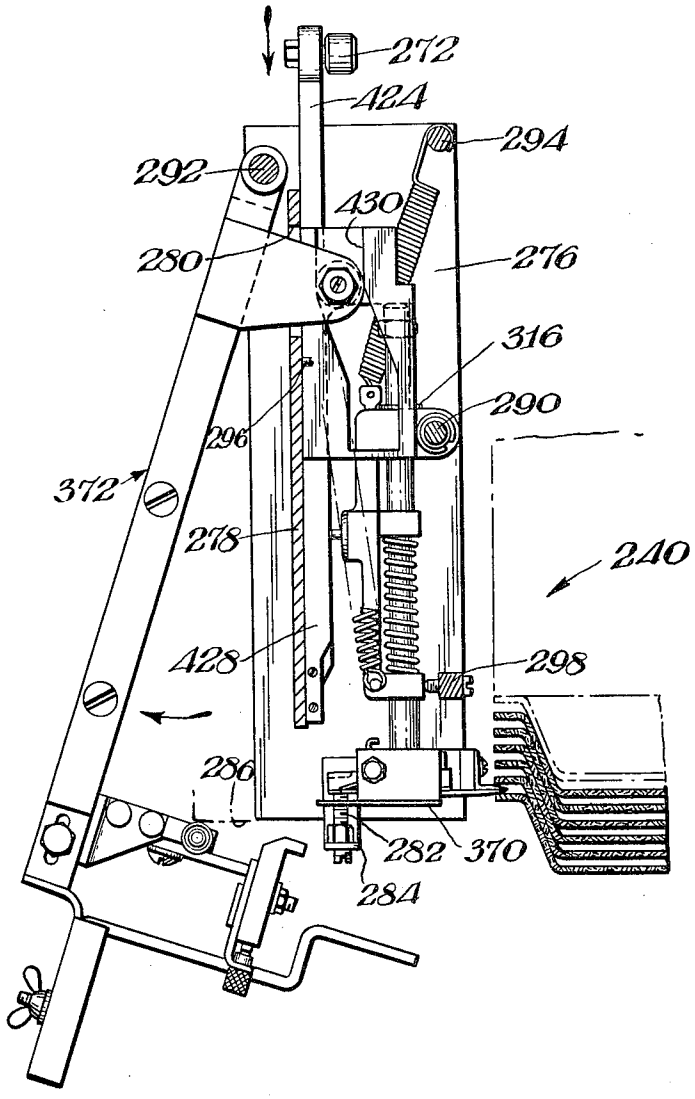
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Fig. 19.



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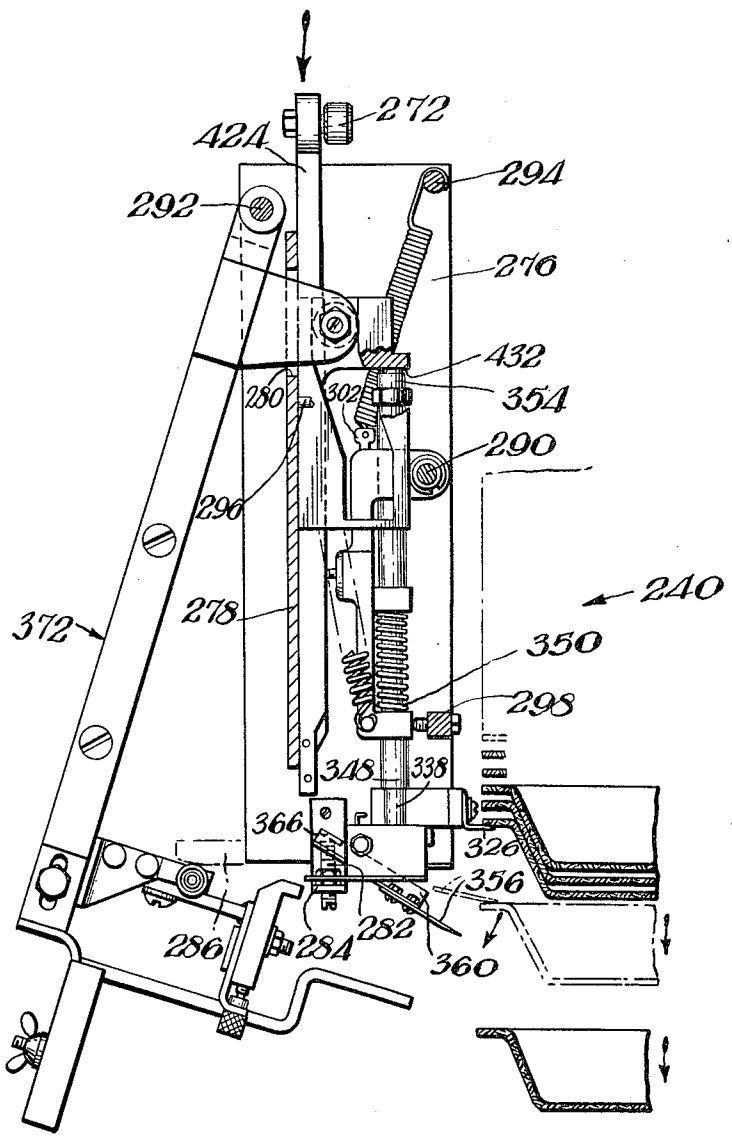
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Fig. 20.



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Nov. 8, 1966 D. E. BURT 3,283,952

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Fig. 24.

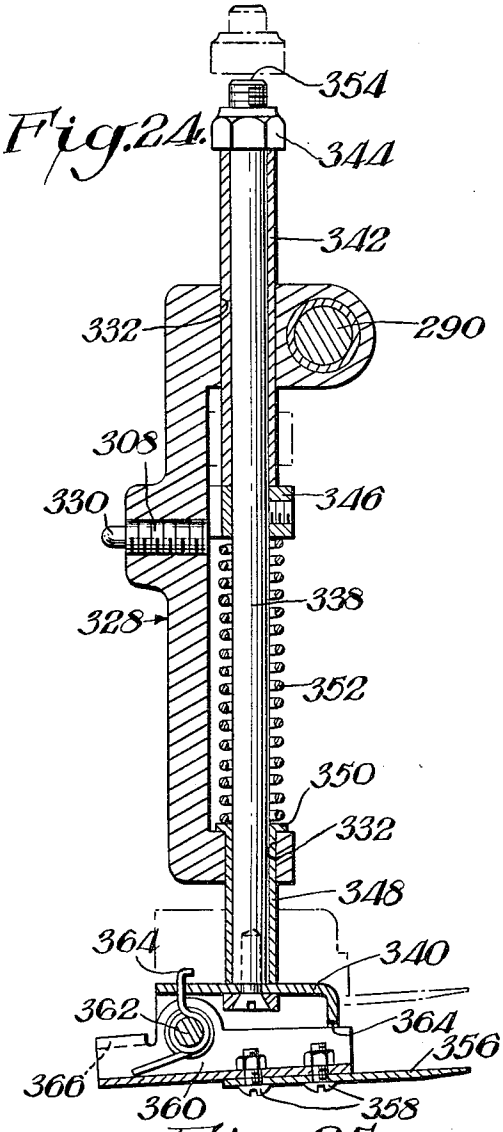


Fig. 21.

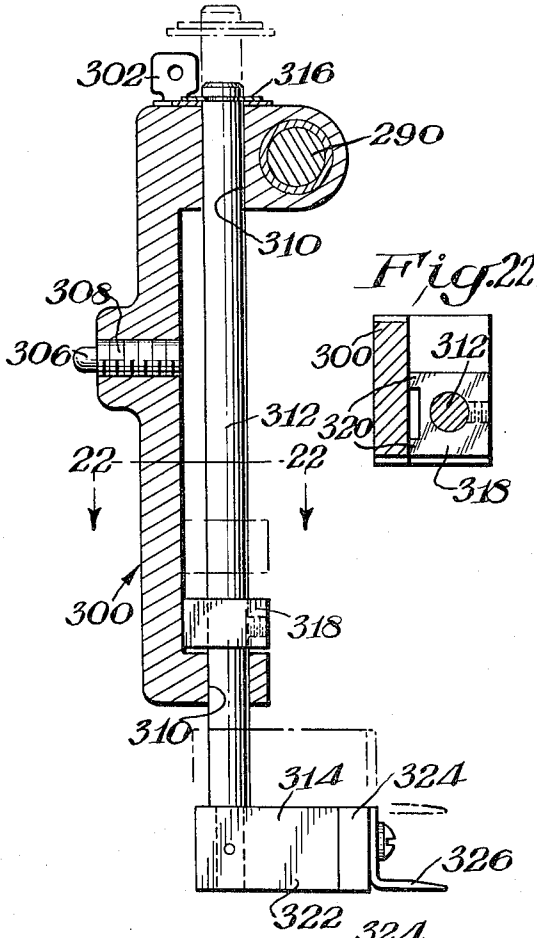


Fig. 22

Fig. 25.

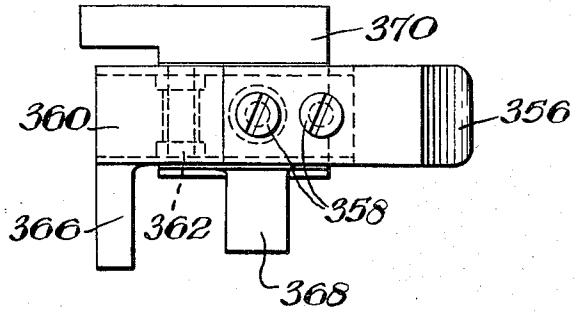
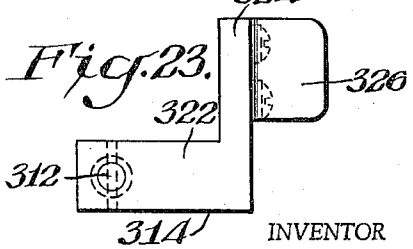


Fig. 23.



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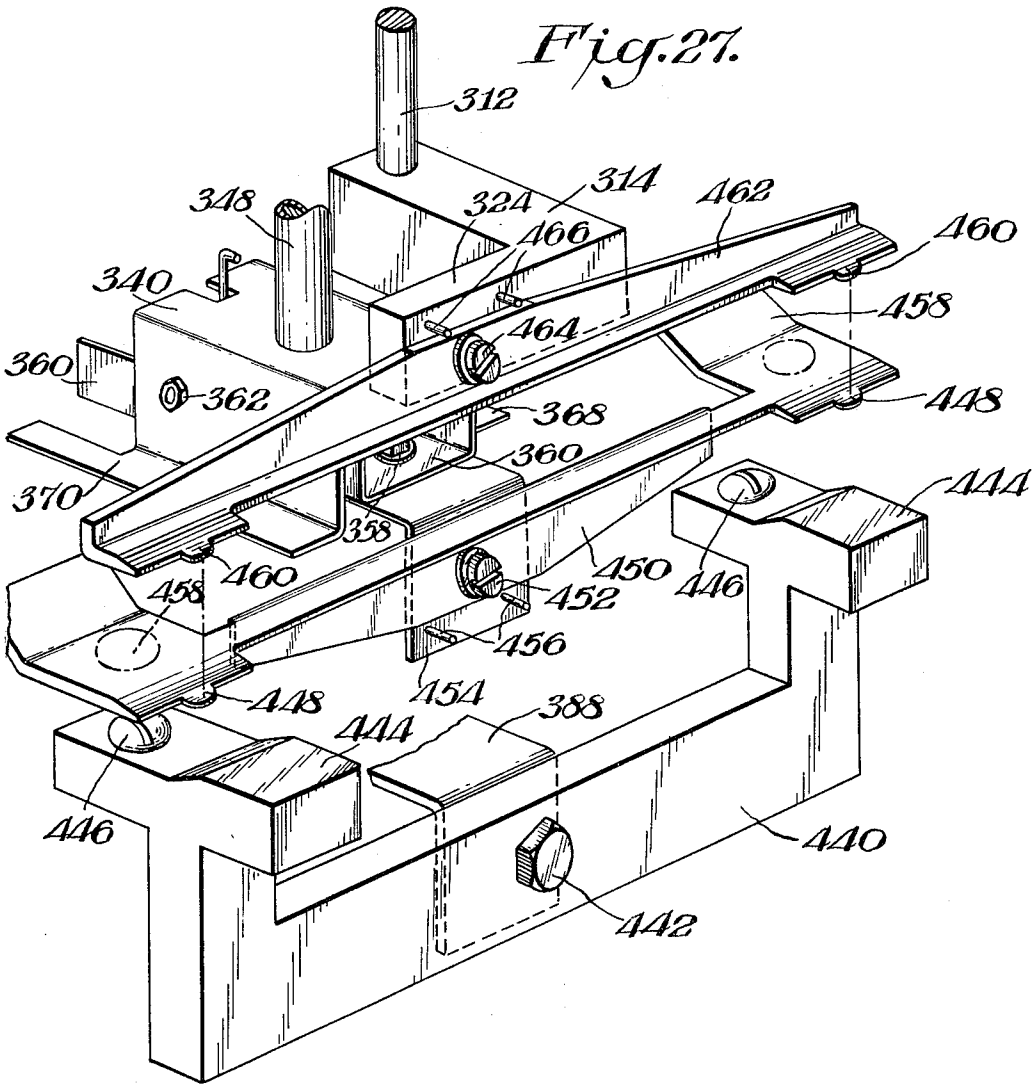
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Fig. 27.



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Fig. 31.

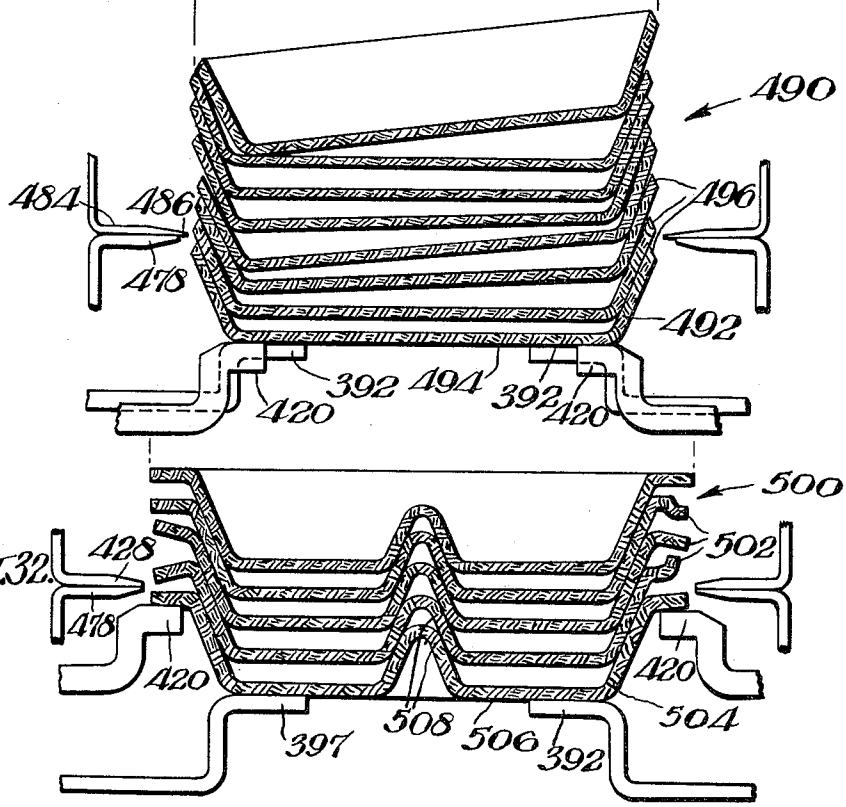


Fig. 32.

Fig. 28.

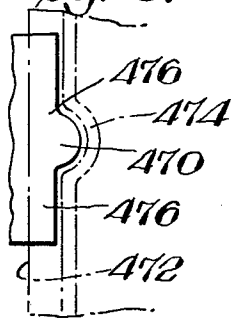


Fig. 29.

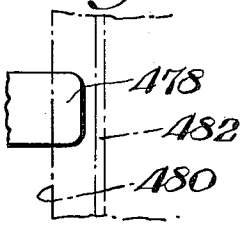
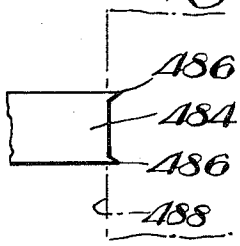


Fig. 30.



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United States Patent Office

3,283,952

Patented Nov. 8, 1966

3,283,952

DISPENSING APPARATUS

Donald E. Burt, Boston, Mass., assignor to Keyes Fibre Company, Waterville, Maine, a corporation of Maine

Filed June 5, 1964, Ser. No. 374,881
14 Claims. (Cl. 221—13)

This is a continuation-in-part of copending and now abandoned application Serial No. 341,372, filed January 30, 1964.

This invention relates to dispensing apparatus for separating articles from a stack of similar articles, and more particularly to apparatus for properly engaging the rim portions of dish-shaped articles to dispense them singly from a nested stack thereof.

The increasing centralization of many high volume packaging operations has resulted in the growth of large and expensive automated packaging lines in which large quantities of packages are filled with various products prior to localized distribution. Moreover, packages such as egg cartons and filler-flats, fruit trays, vegetable and berry boxes and the like are being formed of materials such as molded pulp because of its desirable resiliency combined with strength, as well as other characteristics such as easy disposability and low initial cost. Such packaging articles are conveniently shipped from the molded pulp or other manufacturer to the centralized product packager in nested stacks.

The problem of rapidly separating large quantities of nested articles individually from stacks to feed an automated packaging line is intensified by the roughened surfaces of many materials such as molded pulp. Such surfaces are desirable as a cushioning feature for packaging fragile articles. The inherent frictional resistance of the roughened sides of molded pulp and other articles, however, causes them to cling together in a stack, and forceable separation of one article from another is required.

Prior attempts to separate or de-nest articles of material such as molded pulp singly from a stack thereof have not proved entirely satisfactory. While these proposals frequently include mechanism which adequately strips the articles from the stack, they have failed to overcome the problem of the inherent warpage or distortion frequently encountered in molded pulp articles. For instance, dish-shaped articles may be nested fairly uniformly; however, when such articles include flanged rim portions at their outer margins, the rim portions are frequently warped or distorted to the point where they are not evenly spaced from one another, even though the dished portions of the articles are generally uniformly nested. Consequently, prior de-nesting or dispensing apparatus encounters considerable difficulty in properly engaging in the articles to be dispensed. Either the distorted rim of the article to be dispensed is missed entirely by the stripping mechanism, or the stripping mechanism engages the distorted rim of more articles than are desired to be dispensed. Such misalignment of the stripping mechanism with the flanged rim of the article to be dispensed not only causes malfunctioning and jamming of the dispensing apparatus, but results in considerable wastage due to torn or otherwise mutilated articles.

On the other hand, dished articles which do not include outward flanges at their rims are occasionally nested non-uniformly, which also results in the rim portions being in generally straight but not necessarily uniformly spaced longitudinal alignment.

Additionally, many prior dispensers are motivated by continuously operating rotary power sources such as electric motors driving rotary cam shafts. With such arrangements, it is difficult to stop the machine precisely

at the end of one cycle of dispensing motion to remove jammed articles unless expensive and delicate one-cycle clutches or other such arresting gear, frequently requiring accurate braking apparatus, are provided.

Finally, many proposals for improved dispensing apparatus are so proportioned that the new machinery is not readily adaptable to space requirements of an existing production line, and costly modifications are required in order to keep existing dispensers equipped with competitive operating components.

Accordingly, it is an object of the present invention to provide apparatus for dispensing articles from a stack of similar articles which are not necessarily uniformly spaced in the stack.

Another object of the present invention is to provide dispensing mechanism including means for sensing the true position of articles to be dispensed from a stack and then engaging stripping means with such articles in accordance with such sensing, and cyclically motivating such mechanism from a common drive source including a to-and-fro powering device.

Another object of the present invention is to provide dispensing apparatus driven from a common to-and-fro powering device wherein the actuating mechanism is confined to a minimum of space whereby such mechanism may be incorporated in existing dispensing machinery on established packaging lines.

Other objects and advantages of the present invention will become apparent to one skilled in the art from a reading of the following description in conjunction with the accompanying drawings wherein similar reference characters refer to similar parts, and in which:

FIG. 1 is a plan view of one embodiment of the dispensing arrangement of this invention;

FIG. 1*a* is a side elevational view of the machine of FIG. 1;

FIG. 2 is an enlarged elevational view of the actuating mechanism for the embodiment of FIG. 1;

FIG. 3 is an elevational view similar to FIG. 2 showing the parts half way through one cycle of operation;

FIG. 4 is a sectional elevational view on line **4—4** of FIG. 2 with parts broken away for the purposes of clarity, showing the elements at the beginning of a cycle of operation;

FIG. 5 is a view similar to FIG. 4 showing the elements at a mid-point in the cycle of operation;

FIG. 6 is a view similar to FIG. 4 showing the elements at another mid-point in the cycle of operation;

FIG. 7 is a view similar to FIG. 4 showing the elements at another mid-point in the cycle of operations;

FIG. 8 is a view similar to FIG. 4 showing the elements at the half-way point of the cycle of operation;

FIG. 9 is a sectional plan view on line **9—9** of FIG. 4;

FIG. 10 is a sectional plan view on line **10—10** of FIG. 5;

FIG. 11 is a sectional plan view on line **11—11** of FIG. 7;

FIG. 12 is a plan view of another embodiment of the dispensing arrangement of this invention;

FIG. 13 is a side elevational view of the embodiment illustrated in FIG. 12;

FIG. 14 is a fragmentary elevational view of the modified dispensing arrangement taken from line **14—14** of FIG. 12;

FIG. 15 is a sectional elevational view on line **15—15** of FIG. 14 showing a first step in the sequence of operation;

FIG. 16 is a sectional elevational view similar to FIG. 15 showing another step in the sequence of operation;

FIG. 17 is a sectional elevational view similar to FIG. 15 showing another step in the sequence of operation;

FIG. 18 is a fragmentary elevational view showing details of the sensing finger repositioning cam;

FIG. 19 is a sectional elevational view similar to FIG. 15 showing another step in the sequence of operation;

FIG. 20 is a sectional elevational view similar to FIG. 15 showing another step in the sequence of operation;

FIG. 21 is a fragmentary longitudinal sectional elevational view of the retaining finger support arm;

FIG. 22 is a fragmentary sectional view on line 22—22 of FIG. 21;

FIG. 23 is a bottom plan view of the stack retaining finer support bracket;

FIG. 24 is a fragmentary longitudinal sectional elevational view of the stripping finger supporting arm;

FIG. 25 is a bottom plan view of the stripping finger and its associated housing;

FIG. 26 is a fragmentary longitudinal sectional elevational view of the sensing finger support apparatus and its yieldable motivating device;

FIG. 27 is an exploded perspective view of an alternate pivotal finger arrangement;

FIG. 28 is a fragmentary descriptive view of another form of finger;

FIG. 29 is a fragmentary descriptive view of another form of finger;

FIG. 30 is a fragmentary descriptive view of another form of finger;

FIG. 31 is a semi-schematic view of one variety of article which may be dispensed with apparatus according to this invention; and

FIG. 32 is a semi-schematic view showing another variety of article which may be dispensed with apparatus according to this invention.

The dispensing machine of this invention comprises a housing for supporting a vertical stack of articles. Such a stack may comprise a plurality of nested molded pulp articles having central dished portions and often including marginal outwardly flanged rim portions. Frequently the rim portions of such articles are warped or distorted, and the vertical distance between the bottom of the dished portion and the outer extremity of the rim is irregular and not consistent from article to article. Thus, the rims may be in generally straight but not necessarily evenly spaced longitudinal alignment in such a stack.

The larger the lateral dimensions of the molded pulp articles, moreover, the greater the percentage of warpage which may be encountered. Thus, for large, flexible articles such as pocketed filler-flats for packaging large quantities of eggs in shipping cases, considerable irregularities of the rim portions are to be expected.

Consequently, dispensing machines according to this invention advisably include a plurality of dispensing units, such as the ones described below in full detail, positioned around the bottom of a vertical stack, each adapted to engage rim portions of filler-flats to be dispensed at spaced locations around their peripheries.

Referring in more particularity to the drawings, the first embodiment of the dispensing arrangement of this invention is illustrated in FIGS. 1 through 11. The machine **10** comprises a main framework **12** including four generally vertical sides **14**, **16**, **18** and **20** joined at their vertical edges to form a generally rectangular housing **22** having open upper and lower ends. The rectangular housing **22** defines a vertical path for storage of articles arranged in a stack having a generally vertical axis. If desired, upper extensions may be associated with each side of the framework **12** such as the sheet metal wall portions **24**, **26**, **28** and **30** secured to the upper portion of the sides **14**, **16**, **18** and **20**, respectively. These upper wall extensions define an extension of the housing **22** to support an elongated vertically arranged stack.

A prime motivating arrangement **32** for driving the operating mechanism of the dispensing arrangement may comprise a reciprocable motor such as a polynoid **34** having an outer and an inner telescopically arranged member **36** and **38**, respectively. The outer end of the member **36** is pivoted at **40** to a bracket **42** secured as at **44** to the framework **14**. The outer end of the member **38** is secured as at **46** to a U shaped frame **48**. The free ends of the legs **50** and **52** of the frame **48** are pivoted at **54**, **56**, respectively, to the upper portion of the framework **12**. Linkage members **58** and **60** are pivoted at **62** and **64** to the mid-portion of the legs **50**, **52** of the framework **48**. The telescopic extension and retraction of motivator **34** under the influence of a suitable power source (not shown) produces upward and downward oscillation of the linkage members **58** and **60**, as can be understood. By regulating the power source, the velocity of oscillation may be controlled to operate the dispensing apparatus at the desired cycle rate. The various operating mechanisms of the dispensing apparatus described in detail below are driven through repeated cycles of coordinated motion by the common drive means **32**.

The actual dispensing mechanism conveniently comprises four similar units, two located on one side **14** of the machine and the other two located on the opposite side **18** of the machine. Since all four are similar in structure and follow identical patterns of operation, it will be understood that the following detailed description of one unit **66** serves as a disclosure of all, and the operation of the entire machine will be clear from an explanation of the sequence of operation of the single unit **66**.

The actuating mechanism **66** comprises a fixed upper member **68** and a fixed lower member **70** between which the actuating mechanism is mounted. A generally horizontal bar member **72** is mounted adjacent the upper member **68** for guided vertical travel upwardly and downwardly therebeneath. The bar **72** is biased to its upward position against the member **68** by a suitable spring load as at **74**, and is power driven downwardly as at **76**, as can be understood.

The dispensing mechanism comprises a first or main support means **78** including a retaining ledge portion **80** adapted to support the bottom portions **82** of dished articles **84** arranged in a nested stack. The articles **84** have outwardly flaring rim portions **86** arranged in generally straight but not necessarily evenly spaced longitudinal alignment. The main support **78** is secured to a vertically arranged operating shaft **88** mounted for limited rotary and axial motion between the members **70** and **72**. The shaft **88** includes a radially extending follower pin **90** riding on the upper ramp of a fixed circular cam **92** to impart limited axial motion to the ledge portion **80** as the shaft **88** is rotated. A second radially extending follower pin **94** is positioned to ride in a helical cam groove **96** in a sleeve **98** (omitted for clarity in FIGS. 4–8) which is fixed at its upper end at **100** in the shiftable operating member **72** to receive the upper end of the shaft **88** in telescopic fashion so that up and down reciprocation of the operating member **72** and the sleeve **98** imparts oscillatory motion to the shaft **88**.

A sensing means **102** comprises a finger or ledge portion **104** adapted to engage the lower side of the rim portion **86** of the lowermost article in the stack. The sensing means **102** is rigidly attached to a vertically arranged operation shaft **105** mounted for limited axial and rotary motion between the members **70** and **72**. A radially extending follower pin **106** is positioned to ride in a helical cam groove **108** in a sleeve member **110** fixed at its upper end at **112** to the operating member **72** to telescopically receive the upper portion of the shaft **105**. A second radially extending follower pin **114** is positioned to ride on the upper ramp of a circular cam **116** secured to the upper surface of a retaining finger block **118**, which loosely surrounds the shaft **105**. Oscillatory motion of the shaft **105** imparted by relative vertical reciprocation of the helically grooved cam sleeve **110** results in limited vertical reciprocation caused by the pin **114** riding on the surface of the cam **116**. Optionally, gravity may be as-

sisted by providing a light spring load downwardly on the shaft **105** to insure engagement of the pin **114** with the cam **116**.

The retaining finger block **118** slidably positioned on the shaft **105** is L shaped in plan view and contains a lateral slide member **120** including a retaining finger **122** and a cam follower roller **124**. The slide member **120** is urged by a spring **126** to its rest position wherein the retaining finger **122** is retracted horizontally or laterally beyond the edge of the vertical stack. The retaining finger block **118** is rigidly attached to the bottom extremity of a stop shaft **128**. The upper portion of the stop shaft **128** is slidably received through appropriate bores in the members **72** and **68**, and includes a snap ring **130** above the fixed member **68** to limit downward travel of the retaining finger **122**, as well as the sensing means **102** through the arrangement of the pin **114** and the cam **116** on the top of the retaining finger block.

A stripping finger block **132**, which is also L shaped in plan view, contains a lateral slide member **134** which includes a stripping finger **136** as well as a roller cam follower **138**. The slide member **134** is urged to a rest position by a spring **140** wherein the stripping finger **136** is retracted horizontally or laterally beyond the edge of the vertical stack. A guide shaft **142** is secured at its upper end to the bottom of the stripping finger block **132**, and is mounted at its lower end for vertical sliding movement in a bore **144** in the member **70**. Another operating shaft **146** offset from the guide shaft **142** is secure at its lower end to the stripping finger block **132** and is mounted for vertical sliding motion through a fixed block **148**. An axially fixed snap ring **150** located on the shaft **146** below the fixed block **148** limits upward travel of the stripping finger block **132**. A compression coil spring **152** acting between the fixed block **148** and the upper portion **154** of the operating shaft **146** creates a subservient or yieldable motivating force biasing upwardly the stripping finger block **132**, the retaining finger block **118** which rides thereon, and the operating shaft **105** for the sensing finger mechanism **102**.

To shift the lateral slide members **120** and **134** of the retaining finger block **118** and the stripping finger block **132**, respectively, horizontally inwardly against their individual spring loads, a vertically reciprocating cam actuator is provided. A yoke member **156** taking the form of an inverted U includes an angled cam ramp **158** on one leg thereof and a similarly angled but vertically downwardly offset cam ramp **160** on the other leg thereof. The cam **158** is designed to shift the slide member **134** of the strippling finger block **132** forwardly when downward vertical motion of the yoke **156** causes contact with the roller follower **138**. The other cam **160** is designed to shift the slide member **120** of the retaining finger block **118** forwardly when downward vertical motion of the yoke **156** causes contact with the roller follower **124**.

A stop member **162** depending downwardly from the web or base portion of the yoke **156** is designed to contact the upper surface of the retaining finger block **118** during a predetermined portion of the operating cycle for a purpose described below. The yoke member **156** includes an upwardly extending operating shaft **164** fixed thereto. The shaft **164** is telescopically received at its upper end in a depending sleeve **166** which is fixed at **168** to the operating member **72**. A compression coil spring **170** acts between the lower portion fo the lost motion connection sleeve **166** and the yoke **156** to bias the operating shaft **164** telescopically outwardly of the sleeve **166**. A pin **172** extending diametrally through the sleeve **166** is positioned to ride in an axially extending transverse groove **174** in the shaft **164**. The pin **172** and slot **174** limit outward telescopic motion of the shaft **164** relative to the sleeve **166** as well as inhibit relative rotary motion between the two to prevent misalignment of the cam yoke **156**.

An abutment member **176** fixed to the lower side of the operating member **72** is positioned to engage the upper end **154** of the stripping finger operating shaft **146** midway of the downward travel of the operating member **72**.

In operation of the FIGS. 1–11 embodiment, each downward and upward reciprocation of the operating member **72** drives the above described dispensing apparatus through one complete cycle of operation to dispense a single tray **84** from the bottom of the stack. Describing first the position of the operating mechanism at the beginning of a cycle, the stack retaining finger **122** and the stripping finger **136** are retracted laterally outwardly of the edge of the stack. As best seen in FIGS. 2 and 4, the ledge portion **80** of the support means **78** is swung laterally inwardly of the edge of the stack and supports the bottom **82** of the dished portion of the lowermost article **84**. Essentially the entire weight of the stack of articles is thus supported at the beginning of the operating cycle by the ledge portion **80**. Finally, at the beginning of the operating cycle, the sensing means **102** is swung laterally inwardly of the edge of the stack to position its ledge portion **104** beneath the flared rim **86** of the lowermost article **84** in the stack. The sensing means **102** at this point is biased upwardly to contact the rim **86** of the lowermost article by means of the compression coil spring **152** acting from the fixed block **148** through the following mechanism: spring seat **154**, operating shaft **146** and the stripping finger block **132** secured thereto, retaining finger block **118**, cam **116** on the retaining finger block **118** and the follower pin **114**, and operating shaft **105**. This positions the retaining finger **122** and the stripping finger **136** longitudinally in proper positional relationship with the rim **86** of the lowermost article **84** in the stack. (In FIG. 2, these elements are shown at the upper limit of their possible longitudinal sensing motion with stop **150** up against block **148**; whereas, in FIGS. 4 and 5, they are shown at the lower limit of such possible motion with stop **130** down against member **68**.)

As the operating member **72** begins its descent, the cam **160** on the yoke **156** first engages the roller follower **124** of the lateral slide member **120** in the retaining finger block **118** to shift the retaining finger **122** laterally inwardly beyond the edge of the stack to be inserted between the rims of the lowermost article and the second article in the stack (FIG. 5). As this motion is completed, the cam **158** on the yoke **156** contacts the roller follower **138** of the lateral slide member **134** in the stripping finger block **132** to shift the stripping finger **136** laterally inwardly beyond the edge of the stack and also between the rims of the lowermost and the second article in the stack (FIG. 6).

As the stripping finger **136** is being shifted laterally inwardly, the downward motion of the sleeve **110** rotates the operating shaft **105** through the helical cam groove **108** and its associated pin **106** to swing the ledge **104** of the sensing mechanism **102** laterally outwardly beyond the edge of the stack. Additionally, the pin **114** on the operating shaft **105** rides down the ramp of the cam **116** to impart limited downward vertical travel to the ledge **104** as it swings out from beneath the rim **86** of the lowermost article in the stack. Before the stripping finger **136** has completed its inward lateral movement, and after the sensing finger **102** has begun its outward lateral movement, the ledge portion **80** of the main support **78** begins to be retracted. Downward motion of the sleeve **98** serves to rotate the operating shaft **88** by means of the helical cam groove **96** and its associated follower pin **94** to swing the ledge portion **80** laterally outwardly beyond the edge of the stack. Follower pin **90** also rides down the ramp of the fixed circular cam **92** to generate limited vertically downward travel of the ledge portion **80** to swing it downwardly as well as outwardly from beneath the dished portion **82** of the lowermost article in the stack.

When this motion is completed, the entire stack except the lowermost article is supported on the retaining finger

122. The lowermost article is usually frictionally held against falling by its nested dished portion. The weight of the stack on the retaining finger 122 causes the retaining finger block 118 to move downwardly to the limit of its travel as permitted by the snap ring 130 contacting the upper surface of the fixed member 68. The stripping finger block 132 also follows this movement because it is biased upwardly only by the sensing compression spring 152, which has insufficient power to support the full weight of the stack. As the retaining finger block 118 rides downwardly, of course, the laterally retracted sensing finger 102 also moves downwardly therewith by gravitational bias keeping the pin 114 resting on the upper surface of the cam 116.

When the ledge portion 80 of the support means 78 is fully retracted laterally out of the path of the article to be dispensed, the abutment 176 on the lower side of the operating member 72 contacts the upper end of the operating rod 146 which is thereafter driven downwardly with the operating member 72. Spring 152 is compressed by this motion, and the stripping finger block 132 is shifted downwardly away from the retaining finger block 118 (FIG. 7). This causes the stripping finger 136 to separate the lowermost article in the stack from the balance of the stack supported on the retaining finger 122. Just after such stripping motion begins, abutment member 162 on the yoke 156 engages the upper surface of the retaining finger block 118 which, as mentioned above, is held against further downward travel by the snap ring 130 on the upper end of the operating shaft 128.

The final increment of downward travel of the operating member 72 thus imparts no further motion to the cam yoke 156, such lost motion connection being taken up by compression of the spring 170 and shifting of the pin 172 to the bottom of its cooperating slot 174. Thus, the final portion of the downward travel of the stripping finger block 132 serves to move the roller follower 138 downwardly relative to its now stopped cam 158 to permit the spring 140 to retract the stripping finger laterally outwardly beyond the edge of the stack (FIG. 8). Such retracting of the stripping finger as it undergoes its final increment of longitudinal stripping motion insures that articles are relesaed therefrom if, by chance, the finger had accidentally punctured or otherwise engaged the rim of the article being dispensed in a manner which caused the article to adhere to the finger.

After the operating member 72 has reached the bottom extent of its reciprocating travel (FIG. 3) and begins upward return motion, the foregoing sequence of operation is essentially reversed, and proceeds as follows. Spring 152 biases the stripping finger block 132 upwardly following the retraction of the abutment member 176. This causes the roller follower 138 on the slide member 134 to engage the inclined ramp of still stationary cam 158 and again extend the stripping finger 136 laterally inwardly as it moves up. After the stripping finger 136 has been cammed inwardly, the lost motion connection between the pin 172 and the slot 174 is taken up to nullify the action of the spring 170, and the yoke 156 and its two associated cams thereafter move upwardly concurrently with the operating member 72. When the stripping finger block 132 has moved upwardly into contact with the lower surface of the retaining finger block 118 it is held in this position, and the abutment member 176 separates from the end 154 of the operating rod 146. The stripping finger block 132 is thus held at the lower extent of longitudinal sensing motion by the presence of the retaining finger block 118 which in turn is supporting the entire weight of the balance of the stack.

At this point, the main support means 78 has started to swing laterally inwardly beyond the edge of the stack through the action of the helical cam groove 96 and its associated pin 94. Next, the sensing finger mechanism 102 begins to swing laterally inwardly beyond the edge of the stack by coaction of the pin 106 with its ascending helical cam groove 108 while the inclined cam 158 on the yoke 156 begins to allow retraction laterally outwardly beyond the edge of the stack of the stripping finger 136. By the time the main support 78 and the sensing finger 102 have been oscillated fully to their inner position, the cam 158 has been elevated to the point where the stripping finger 136 is fully retracted laterally outwardly of the edge of the stack. As the main support 78 and the stripping finger 102 are rotated inwardly, of course, they are elevated slightly by their respective vertical cam arrangements 90, 92 and 114, 116. Finally, the last increment of upward retraction of the operating mechanism 72 withdraws the inclined cam 160 from the roller follower 124 allowing retraction laterally outwardly of the retaining finger 122.

When the retaining finger 122 is retracted, the entire stack of articles 84 settles by gravity until the bottom 82 of the lowermost dished article contacts the ledge portion 80 of the support means 78. At this point, the sensing finger 102, as well as the stripping finger 136 and the retaining finger 122 which follow it, are at the lower extent of their logitudinal sensing motion as defined by the snap ring 130 resting on the member 68. If the flanged rim 86 of the new lowermost article in the stack is warped slightly upwardly beyond a mid-position, the action of sensing spring 152 generates upward sensing motion of the sensing finger 102 by means of the stripping finger block 132 and the retaining finger block 118. When the ledge portion 104 of the sensing finger 102 contacts the flanged rim of the lowermost article, such upward motion is stopped because, it will be remembered, the spring 152 has insufficient power to support the entire weight of the stack. This positions the retaining finger 122 and the stripping finger 136 longitudinally adjacent the rim of the lowermost article irrespective of distortion or warpage of such rim, because these two fingers have floated upwardly in fixed relation to the finger or ledge portion 104 of the sensing means 102. At this point, the entire cycle of operation is complete, the lowermost article of the stack having been stripped downwardly therefrom and the parts having repositioned themselves adjacent the flexible flanged rim of the new lowermost article preparatory to repeating the above cycle of operation.

Referring now to FIGS. 12–26, a modified version of the dispensing apparatus according to this invention is illustrated in detail. As best seen in FIGS. 12 and 13, the machine 210 includes a pair of opposed, generally vertical, main frame support plates 212 and 214. These plates are tied together by horizontal connecting rods 216 suitably secured at their extremities to the bottom corners of the plates 212 and 214. A pair of adjusting rods 218 are secured adjacent the upper corners of the plates 212 and 214. The upper rods 218 each include left-hand and right-hand thread portions, and are mounted for rotary motion in the frame plates 212 and 214. Each rod 218 includes a sprocket wheel 220 interconnected for concurrent rotary motion by a link chain 222. One of the rods 218 further includes a manual crank arrangement 224, rotation of which imparts concurrent rotary motion to the rods 218.

A pair of adjustable side frame plates 226 and 228 are mounted for concurrent lateral adjustment toward and from the centerline of a stack of articles to be dispensed. Each adjustable frame plate includes a pair of traveling nuts 230, 232, respectively, secured for rotary vernier adjustment as at 234, 236, respectively, and threaded on the left-hand and right-hand threaded portions of the rods 218, respectively. Thus, it will be clear that rotary motion imparted to the adjusting rods 218 by the crank 224 causes inward and outward adjusting motion of the frame plates 226 and 228. Each adjustable frame plate 226, 228 further may include vertical guides 238 extending above the upper margin thereof to guide vertical downward travel of a stack of articles being dispensed.

Each frame plate 226, 228 is adapted to support at least one dispensing unit 240 by means of four fasteners 242 for easy removal. Each dispensing unit 240 is actuated by a common reciprocating drive arrangement. Such arrangement includes a fluid motor 244 having a cylinder 246 connected to the cross-bar 216 and a telescopically associated piston, the rod 248 of which is pivotally connected with a cross-bar 250. Pressurized fluid admitted to the motivator 244 through a connection 252 extends the bar 250 upwardly, and pressurized fluid admitted to the motivator through another connection 254 serves to retract the bar 250, as can be understood. Suitable valving arrangements incorporated in a standard hydraulic system may be employed to control velocity of reciprocation of the motivator 244.

The bar 250 slidably connects with the outer ends 256 of a pair of twin lever arrangements 258, each of which is pivoted at 260 to one of the laterally adjustable frame plates 226, 228. The other end of each lever 258 is pivotally connected as at 262 with a connecting link 264 which in turn is connected with an adjustable operating member 266. Each operating member 266 is mounted for vertical reciprocatory motion on a suitable guide rod 268 whereby extension and retraction of the motivator 244 imparts up and down shifting motion to the operating members 266. Each operating member 266 further includes a horizontal groove 270 adapted to engage a follower member 272 on a reciprocal portion of each dispensing unit 240 for operation thereof.

Each detachable unit 240 comprises a self-contained dispensing unit consisting primarily of a pair of side frame plates 274 and 276 connected together by a rear frame plate 278. The rear frame plate 278 includes an opening or window 280 for a purpose described below, and the inner surface thereof serves as a backing support for a pair of cam bars, also explained below. The lower portion of the side frame plate 276 supports an adjustable stripping finger trip member 282 upon a suitable L bracket 284. The lower portion of the side frame plate 274 supports a cam block 286, the lower surface 288 of which is contoured to shift the sensing finger member to its lowermost limit of longitudinal travel in a manner described below. A pair of trunnion shafts 290 and 292 connect between the side frame plates 274 and 276 for mounting oscillating support members. A spring support 294 is secured to the upper portion of the side frame 276, and a spring support 296 is secured to the rear frame plate 278. Finally, a stop bar 298 connects between the forward portions of the side frame members 274 and 276. A pair of adjustable stop members horizontally threaded through the stop bar 298 serve to establish the innermost lateral position of arm support members, described below.

The basic framework of each dispenser unit described above further includes a series of shifting arms to control lateral and longitudinal motion of a plurality of finger means which serve to dispense articles singly from the end of a longitudinal stack thereof. A first arm or support 300 is pivotally mounted at its upper end on the pivot shaft 290 and includes a mounting 302 for one end of a coiled tension spring 304 which is secured at its other end to the spring support 294 to bias the arm clockwise about the shaft 290, as viewed in FIG. 21. A cam follower 306 is adjustably threaded at 308 in the arm 300 to control counterclockwise oscillation of the arm about the shaft 290 in response to reciprocal motion of a cam operating member, described below. The arm 300 further includes a pair of spaced, aligned bores 310 therethrough which are concentric about a common vertical centerline.

The arm 300 further includes a support rod 312 slidably mounted in the aligned bores 310, and supporting a retaining finger bracket 314 on the lower end thereof. Longitudinally upward sliding of the rod 312 in the arm 300 is limited by the bracket 314, and downward shifting motion thereof is limited by a snap ring 316 secured to the shaft 312. Rotary motion of the shaft 312 in the bores 310 is precluded by a yoked collar 318 including a pair of feet 320 riding against the smooth inner surface of the arm 300.

The retaining finger bracket 314 includes an inwardly extending portion 322 and a cantilevered off-set portion 324 shaped to position a retaining finger 326 in proper positional relationship to a stack of articles. Thus, it will be clear that the retaining finger 326 is mounted for lateral shifting motion toward and away from a stack of articles by pivotal motion of the arm 300 about the fixed shaft 290, and the retaining finger 326 is also mounted for limited free longitudinal travel upwardly and downwardly of a stack of articles by sliding motion of the shaft 312 in the spaced, aligned bores 310 in the arm 300.

A second arm support 328 is also mounted for limited oscillatory motion on the cross pivot shaft 290. The arm 328 is generally similar in structure to the arm 300, and thus includes an adjustable cam follower portion 330 as well as a pair of spaced aligned bores 332, FIG. 24. A pin 334 connects with one end of a coil tension spring 336 which is attached at its other end to the spring connection 296 on the rear frame plate 278. Thus, clockwise motion of the arm 328 urged by the spring 336 is limited by the cam follower 330 engaging a cam described below, which in turn controls counterclockwise pivotal motion of the arm which is limited by engagement of the lower extremity of the arm with the cross-bar stop 298.

A slide rod 338 supports a stripping finger housing unit 340 at its lower extremity. The slide rod 338 is surrounded at its upper portion by a spacer sleeve 342 which in turn is received for sliding motion in the upppermost of the aligned bores 332. The sleeve 342 is fixed longitudinally relative to the slide rod 338 by means of a stop nut 344 and a yoked collar 346 which also precludes rotary motion of the stripper finger housing 340 about the longitudinal axis of the rod 338. A second sleeve 348 slidably received upon the lower portion of the rod 338 is mounted for sliding longitudinal travel in the lowermost of the aligned bores 332. An outwardly flanged shoulder 350 at the upper end of the sleeve 348 prevents downward travel of the sleeve beyond a predetermined limit in the arm 328. A compression coil spring 352 acting between the yoke collar 346 and the flange 350 of the lower sliding sleeve insures that the stripper finger housing 340 attached to the lower end of the shaft 348 is normally biased upwardly into contact with the lower end of the flanged sleeve 348. In this condition, the entire mechanism associated with the shaft 338 and its associated stripping finger housing 340 is capable of limited free longitudinal travel through the bores 332 in the arm 328 relative to a stack of articles to be dispensed. During such motion, the upper sleeve 342 and lower sleeve 348 travel with the shaft 338 as a unit, the compression coil spring 352 being entrapped and rendered ineffective.

It will be appreciated that downwardly directed forces applied to the upper extremity 354 of the shaft 338 will cause downward travel of the entire mechanism until the flange 350 of the lower sleeve 348 engages with the lower portion of the arm 328, and thereafter the shaft 338 and its associated sleeve 342 continue to travel downwardly relative to the now stopped sleeve 348, causing compression of the coil spring 352. This shifts the stripping finger housing 340 downwardly away from the arm 328. Thus, it will be clear that the stripping finger housing 340 is capable of lateral to-and-fro shifting motion relative to a stack of articles by swinging of the arm 328 about the shaft 290. The stripping finger housing 340 is also capable of limited free travel in a longitudinal direction by shifting of the sleeves 342 and 348 concurrently relative to the arm 328. Additionally, the stripping finger housing 340 may be shifted independently of the arm 328 in a longitudinal direction by forces applied to the upper extremity 354 of the shaft 348 with a resulting compression of the coil spring 352.

The stripping finger housing **340** comprises a stripping finger member **356** pivotally mounted therein. The stripping finger member **356** includes a detachable finger portion secured as at **358** to a pivoted support bracket **360**. A pin **362** mounts the bracket **360** for pivotal motion in the stripping finger housing **340**. A coil torsion spring **364** engaging the housing **340** at one end and engaging the bracket **360** at the other end normally biases the housing **360** counterclockwise until the forward or inner extremity of the support bracket **360** engages a downwardly directly edge portion **364** of the housing. The outer or rear portion of the bracket **360** includes a laterally extending tab **366** adapted to engage the abutment **282** secured to the side frame plate **276** to cause clockwise pivotal motion of the stripping finger bracket **360** and its finger **356** about the pin **362** relative to the housing **340** upon downward motion of the housing **340**.

The housing **340** further includes a laterally extending tab **368** adapted to ride beneath the inwardly extending portion **322** of the retaining finger bracket **314**, whereby the retaining finger **326** will follow the limited free longitudinal travel of the stripping finger housing **340**. On the other side of the stripping finger housing **340**, an elongated flange **370** is adapted to ride upon a roller associated with the sensing finger apparatus, described below.

A third arm or support member **372** comprises a pair of elongated side members **374** pivoted at their upper end on the cross-shaft **292**. The side members are secured to a central slide member **376** which includes a longitudinal bore **378** having stepped up shoulder recesses to receive a pair of sleeve bearings **380** at the upper and lower ends thereof. A lower abutment bracket **382** spans the lower extremities of the side members **374**, and is longitudinally adjustably secured thereon by slotted fastener arrangements **384**. The lower abutment member **382** includes a ledge support bracket **386** to which an inwardly extending ledge member **388** is adjustably secured as at **390**. The ledge member **388** includes a portion **392** which is adapted to support the lower surfaces of dished portions of end articles in a stack of articles.

One of the side members **374** includes a fordwardly or inwardly extending cam follower bracket **394** extending through the window **280** which pivotally supports a follower roller **396** adapted to ride in a grooved cam, explained below. The bearing sleeves **380** support a guide shaft **398** for limited travel longitudinally of a stack of articles. The upper portion of the shaft **398** includes a spring seat portion **400**, and the lower portion thereof includes an inwardly extending support **402**. A compression coil spring **404** acts between the upper surface of the spacer member **376** and the spring support portion **400** of the shaft **398** to impart an upward bias thereto relative to the support arm **372**. A stop pin **406** concentrically secured to the bottom portion of the shaft **398** is adapted to abut the spanner support **382** to limit downward travel of the shaft **398** compressing the spring **404**. A longitudinal guide bracket **408** is secured as at **410** to the arm **402** to insure that the arm **402** is precluded from rotary motion about the axis of the shaft **398**. The arm **402** further includes a roller **412** adapted to ride beneath the flange **370** of the stripping finger housing **340** as well as beneath the contoured lower surface **288** of the fixed cam member **286**, for a purpose described below.

Secured as at **414** to the arm **402** is an inwardly directed bracket **416** which adjustably supports as at **418** a sensing finger member **420**. The adjustable support for the sensing finger member **420** may include a longitudinal finger tip adjustment **422** to insure proper registry of the sensing finger **420** with the end articles in a stack relative to the stripping finger **356** and the stack retaining finger **326**.

The above mentioned follower member **272** which coacts with the horizontal slot **270** of the operating member **266** includes a series of cam contours mounted for vertical or longitudinal reciprocation to actuate the above described operating members of the dispensing unit **240**. A connecting arm **424** extends longitudinally to ride against the inner face of the rear frame member **278**. A first cam **426** is positioned for longitudinally vertical travel adjacent the cam follower **306** of the first support are **300**. A second cam **428** is positioned adjacent the cam follower **330** of the second support arm **328**. These two cams are contoured to shift the arms **300**, **328** laterally inwardly of a stack in a predetermined sequence upon downward reciprocation of the connecting arm **424**.

A third cam arrangement includes a slot or grooved cam **430** engaging the roller follower **396** of the ledge support and sensing finger arm **372**. The contours of the cam **430** are designed to swing the arm **372** laterally outwardly of a stack upon downward motion of the connecting arm **424**.

Finally, an abutment shoulder **432** is positioned to engage the upper extremity **354** of the shaft **338** which supports the stripping finger housing **340**. This comprises a lost motion connection which comes into engagement during the operating cycle to shift the stripping finger housing **340** downwardly against the bias of the coil spring **352** to drive the finger tilting tab **366** into engagement with the abutment **282**, in a manner explained in more detail below.

In operation, the above described mechanism of FIGS. 12–26 operates through a coordinated sequence of motion responsive to inward and outward reciprocation of the motivator **244**. Describing first the position of the operating mechanism at the beginning of a cycle, as seen in FIG. 15 the stack retaining finger **326** is oscillated laterally outwardly of the stack by the coil tension spring **304** until the cam follower **306** engages the outer or base portion of the reciprocal cam **426**. The stripping finger **356** is also shifted laterally outwardly of the stack by the tension spring **336** until the cam follower **330** of the arm **338** engages the outer or base portion of the cam **428**. The sensing finger **420** mounted on the arm **372**, and the ledge support member **392** also mounted on the arm **372**, are shifted laterally inwardly of the stack by the follower **396** riding in the lower portion of the groove cam track **430**. The ledge portion **392** which is longitudinally fixed relative to the rest of the dispensing unit **240** supports the lower dished portions **82** of articles **84** in the stack. The sensing finger **420** is in engagement with the lower or longitudinally outer surface of the rim portion **86** of the end article in the stack. The operating member **266** is at the uppermost limit of its reciprocating travel. With the parts in this position, the dispensing unit is ready to commence a cycle of operating motion which proceeds as follows.

First, as the operating member **266** drives the various cam contours downwardly, the rise portion of the cam **426** engaging the follower **306** shifts the arm **300** about its pivot **290** through a small degree of angular motion to impart laterally inward shifting motion to the stack retaining finger **326**. As explained in more detail below, the stack retaining finger **326** has been properly positioned relative to the article to be dispensed from the stack so that it engages between the flanged rim portions of the first and second articles in the stack, as can be seen in FIG. 16.

Next, the rise contour of the cam **428** engaging the follower **330** of the arm **328** imparts a small degree of angular motion thereto about the pivot **290** to shift the stripping finger **356** laterally inwardly of a stack. This finger also has been properly positioned in a manner described below by the sensing finger to engage between the flanged rims of the first and second articles in the stack. As the stripping finger **356** is being shifted laterally inwardly, the contoured portion of the grooved cam **430** begins to shift the sensing finger and ledge support arm **372** outwardly about the pivot **292**, as seen in FIG. 17.

Continued downward motion of the cam operating members serve to swing the sensing finger **420** and the ledge support **392** laterally outwardly of the stack beyond the edge thereof to clear the path which will be followed by the article dispensed from the end thereof. It will be noted that the pivot **292** for the sensing finger and ledge support is located sufficiently laterally outwardly of the stack to impart an increment of longitudinal outward motion to these two members as they are swung away from the bottom or end of the stack. As the support portion **402** for the sensing finger is swung laterally outwardly, the roller **412** is cammed out of engagement with the lower surface of the flange **370** of the stripping finger housing **340**. The cam **286** is postioned so that the lower surface **288** thereof engages the roller **412** on its laterally outward stroke to shift the sensing finger **420** longitudinally outwardly to the limit of its travel. At this point, the entire stack except for the lowermost article thereof is supported by the upper surface of the stack retaining finger **326**. Downward or longitudinally outward motion of the stack retaining finger **326** is limited by the snap ring **316** on the shaft **312**, as seen in FIG. 19.

Further downward motion of the cam arrangement brings the lost motion abutment shoulder **432** into engagement with the upper extremity **354** associated with the stripping finger housing **340** to impart downward or longitudinally outward motion thereto. As the shaft **338** is driven downwardly through the now stationary lower sleeve **348** with a resulting compression of the spring **352**, the stripping finger **356** which is retained against upward pivotal motion about its pin **362** by the shoulder **364** imparts longitudinal motion to the lowermost article of the stack to forceably separate it from the balance of the stack. The balance of the stack is retained by the stack retaining finger **326** which does not partake of stripping motion because the snap ring **316** on the upper end of the shaft **312** inhibits downward or longitudinally outward motion thereof. As the stripping finger housing **340** moves downwardly, the retaining finger bracket support tab **368** moves downwardly away from the retaining finger bracket **314**, and the housing **340** itself moves away from the trapped sleeve **348**. This stripping motion serves to forceably separate the lowermost article from the stack of articles.

In the event that the stripping finger **356** has inadvertently punctured the flanged rim of the lowermost article of otherwise engaged it in a manner which causes the article to adhere to the finger, a further motion is provided to insure adequate separation of dispensed articles from the stripping finger itself. To this end, the lateral tab **366** comes into engagement with the adjustable abutment screw **282** and begins to pivot the stripping finger **366** about the pin **362** through a quadrant directed both longitudinally outwardly and laterally outwardly of the stack, as seen in FIG. 20. This provides an increment of laterally outward motion of the stripping finger to shift it out of the path of articles being dispensed. When the required degree of swinging or tilting motion has been imparted to the stripping finger **356**, the cam actuating mechanism is at the lowermost portion of its reciprocating motion.

On return upward motion of the cam operating members, the above described sequence of operation is repeated essentially in inverse order. For instance, initial upward motion of the cam members allows the coil torsion spring **364** to return the stripping finger **356** to its horizontal position where it engages the abutment **364** of the housing **340** as the housing **340** shifts the pivot **362** upwardly in relation to the fixed abutment **282**. Continued upward retraction of the cam elements retracts the shaft **338** within its lower sleeve **348** until the upper surface of the housing **340** abuts the lower end surface of the sleeve **348**, and the retaining finger bracket support tab **368** engages the lower surface of the inwardly extending portion **322** of the retaining finger bracket **314**. At this point, the groove cam **430** begins imparting inward lateral motion to the arm **372** which carries the sensing finger **420** and the stack support ledge **392**. During this inward lateral motion, the contour **288** on the lower surface of the cam **286** serves to retain the sensing finger support shaft **398** at its longitudinally outward or lowermost limit of travel. When the roller **412** is moved sufficiently laterally to engage the flange **370** on the housing **340** for the stripping finger, the sensing finger **240** is retained at essentially its outer limit of longitudinal travel because the housing **340** for the stripping finger is retained in its lowermost position of floating free travel by the support tab **368** which engages the lower surface of the retaining finger block **314**. It will be recalled that the retaining finger **326** at this point is still supporting the entire weight of the stack, and the sensing spring **404** surrounding the shaft **398** for the sensing finger has insufficient strength to support the entire weight of the stack.

As the ledge support **392** and the sensing finger **420** are shifted to their laterally innermost location beneath the stack, with the sensing finger still retained in its longitudinally outermost position by the roller **412** engaging the lower surface of the flange **370**, the upward travel of the cam **428** permits the tension spring **336** to swing the arm **328** laterally outwardly of the stack to retract the stripping finger **356** to its rest position laterally outwardly of the stack. The lateral extent of the flange **370** is sufficient to maintain continued engagement with the top of the roller **412** to insure that the sensing finger is retained at its longitudinally outermost limit of travel even when the stripping finger **356** is retracted laterally. This, of course, is because the stripping finger housing **340** is still maintained in its lowermost or longitudinally outward position by the pressure of the retaining finger bracket **314** acting on the support tab **368** since the retaining finger **326** still supports the entire weight of the stack through the snap ring **316**.

The final increment of upward translation of the cam operating elements serves to withdraw the rise portion of the cam **426** from behind the follower **306** of the support arm **300** to permit the tension **304** to retract the stack retaining finger **326** laterally outwardly of the edge of the stack. At this point, the weight of the stack no longer acts on the stack retaining finger to force the roller **412** associated with the sensing finger **420** to the lowermost limit of its longitudinal travel. Consequently, the sensing spring **404** surrounding the operating shaft **308** biases the sensing finger **420** longitudinally inwardly of the stack until the outermost surface of the flanged rim of the end article in the stack is contacted. This longitudinal inward motion of the sensing finger is followed by the laterally retracted stripping finger **356** because of the flange **370** riding on the roller **412**. This motion is also followed by the stack retaining finger **326** because the lower portion of the bracket **322** rides on the support tab **368** of the housing **340**. Also, as this inward lateral motion is taking place, the balance of the stack is motivated by gravity longitudinally outwardly until the bottom surface of the dished portion of the new end article contacts the ledge support **392**. Even though the sensing finger **420** engages the new lower flanged rim before the stack has shifted forwardly or downwardly, it will be recalled that the power of the sensing finger spring **404** is insufficient to support the entire weight of the stack. Thus, the spring will not prohibit forward shifting of the entire stack until the dished portion of the new end article engages the ledge portion **482**. Obviously, if the flange of the end article is wraped upwardly beyond a normal position, the sensing spring **404** will motivate the sensing finger **420** upwardly until it engages such a flange. The presence of an article rim against the sensing finger **420** prohibits further inward longitudinal motion of the laterally retracted stripping finger **356** and the laterally retracted stack retaining finger **326** which are both following the sensing motion of the sensing finger. At this

point, the cam operating members are shifted fully upwardly to complete the cycle of operating motion.

Referring to FIG. 27, an alternate finger arrangement is illustrated. Instead of the single fingers described above which engages with articles to be dispensed, the mechanism according to FIG. 27 includes cooperating pairs of pivotally mounted fingers. This arrangement is especially useful for engaging large, flexible articles such as filler-flats and the like which have spaced de-stacking areas on opposite sides thereof.

Such an arrangement comprises a cross-bar **440** pivotally mounted at **442** on the forwardly or inwardly extending bracket **388** of the sensing finger mechanism described above in connection with the embodiment of FIGS. 12–26. A pair of sensing finger elements **444** are integrally formed on the laterally outward extremities of the cross-bar **440** for engaging the lower or longitudinally outer surfaces of flanged rims of end articles in a stack. Guide abutments **446** taking the form of adjustable screw heads may also be included on the cross-bar **440** adjacent and laterally outwardly of the finger elements **444**.

A pair of stripping finger elements **448** integrally mounted on the extremities of a second cross-bar **450** may be located longitudinally directly in line with the sensing finger elements **444**. The cross-bar **450** is pivotally mounted at **452** on an extension **454** which is secured as at **358** to the stripping finger bracket **360**. A pair of limit pins **456** may be provided on the bracket **454** to limit angular motion of the cross-bar **450** about its pivot **452**. A pair of abutment flanges **458** associated with each stripping finger element **448** are adapted to be engaged by the abutment screw heads **446** associated with the sensing fingers **444**.

Finally, a pair of stack retaining fingers **460** located in longitudinal alignment with the stripping finger elements **448** and the sensing finger elements **444** are integrally associated at the extremities of a cross-bar **462** which in turn is pivotally mounted at **464** on the laterally extending portion **324** of the retaining finger bracket **314**. A pair of limit pins **466** may be incorporated on the bracket **314** to limit angular motion of the cross-bar **462** about its pivot **464**. Tilting angular motion of the cross-bar **462** is controlled by contact between the retaining finger elements **460** and the stripping finger elements **448**, the flange **368** on the stripping finger housing **340** serving to maintain the retaining finger bracket **314** sufficiently spaced from the bracket **454** to permit limited angular motion of the cross-bars **450** and **462**. Thus, it will be clear that the sensing finger elements **444** will position themselves against the leading surface of flanged rims at two spaced points on each side of such large, flexible articles. The stripping finger elements **448** will accordingly position themselves properly for engagement with the flanged rims at such spaced points, the stack retaining elements **460** following such longitudinal positioning. Other operational movements of the three finger means proceeds according to the steps outlined above in connection with the embodiment of FIGS. 12–26.

Referring to FIGS. 28–30, a series of different types of finger means are illustrated which may be used singly, or in pairs on the extremities of pivoted cross-bars as in FIG. 27. In FIG. 28, a finger **470** includes a central laterally inwardly extending tab adapted to engage beneath a flanged rim **472** adjacent an inwardly contoured buttress rib **474** on the side wall of a dished article. Lateral wing portions **476** adjacent the tab **470** also engage beneath the flanged rim **472** to insure maximum contact with such a rim. In FIG. 29, a single tabbed finger **478** is shown engaging beneath a flanged rim **480** flaring outwardly from the upper portion of a dished side wall **472**. In FIG. 30, a finger **484** including sharpened prong elements **486** is illustrated in engagement with the side wall portion **488** of an article of the type which does not include laterally outwardly flanged portions at its rim.

In FIG. 31, a stack of articles **490** of the type which includes dished portions **492** the bottoms **494** of which rest on ledge supports **392** is illustrated. The rims **496** of such articles do not include outwardly flanged portions. Consequently, it is possible for such articles to be disarrayed in a stack to the point where such rim portions **496** are in essentially straight longitudinal alignment but are not evenly spaced in the stack. With such a stack of articles, it is advisable to utilize a stack retaining finger of the type illustrated in FIG. 30 which includes sharpened prong elements **486** to engage and puncture the non-flanged rim portion of second articles in the stack to retain the balance of the stack thereabove. Stripping fingers usable with such a stack may include either the pronged type or the type illustrated in FIG. 29 wherein a tab finger **478** is adapted to engage the rim portion of lowermost articles in the stack which are to be dispensed. With this arrangement, it will be noted that the sensing finger **420** is positioned to engage the bottom surface **494** of the dished portions. Thus, it will be clear that misaligned articles will contact the ledge portion at only one side thereof, the sensing finger **420** riding upwardly to engage the other or higher side thereof and carrying the stripping finger and stack retaining finger upwardly therewith so that the latter will be properly located adjacent the non-flanged rim of the article to be dispensed.

In FIG. 32, finally, a stack of articles **500** of the type including flexible flanged rims **502** as well as dished portions **504** having bottom surfaces **506** is illustrated. Frequently, with such articles, at least one upstanding double wall rib element **508** is provided for partitioning the articles into a plurality of pocket portions. Such ribs **508** have the effect of preventing misalignment of articles in the stack as is the case with articles such as the ones illustrated in FIG. 31. However, it will be noted that the flexible flanged rims **502** are capable of misalignment in themselves to the point where the rim portions are in longitudinal alignment but not necessarily evenly spaced. With such a stack of articles, it is advisable to have the ledge **392** engaging the bottom surfaces **506** and to have the sensing fingers **420** engaging the lower surface of the flanged rim of the lowermost article in the stack. This, as explained in detail with the embodiments of the invention illustrated heretofore, properly positions the stack retaining fingers and the stripping fingers properly for engagement between the rims of the first and second articles in the stack. Again with this arrangement, it is possible to utilize any of the varieties of the fingers illustrated in FIGS. 28–30.

Thus, a dispensing arrangement has been disclosed which determines the longitudinal positions of rims of articles to be dispensed relative to a nested stack of such articles and thereafter acts upon the rims of such articles to remove them from one end of the stack, all in response to a single to-and-fro oscillation of an extensible motivator. Moreover, the dispensing arrangement of the FIGS. 1–11 embodiment comprises strictly mechanical actuating mechanism confined to a very narrow vertically extending space, capable of insertion on existing machinery of established packaging lines. The dispensing arrangement of FIGS. 12–26 embodiment also comprises strictly mechanical actuating mechanism designed as removable units and capable of use with interchangeable parts to be useful for dispensing a wide range of articles.

While the above described embodiments constitute preferred modes of practicing this invention, many other embodiments and equivalents may be resorted to within the scope of the actual invention, which is claimed as follows.

What is claimed is:

1. An arrangement for dispensing articles from one end of a stack thereof, the articles being of the type having lateral rim portions, comprising means for holding a longitudinal stack of such articles with their rim portions in generally straight alignment defining an edge of

the stack, dispensing means connected to remove end articles individually from one end of a stack in the holding means including a finger support member mounted for independent longitudinal travel away from and back to the end of the stack to effect removal of end articles away from the stack, a stripping finger member mounted on the support member for shifting laterally into and out of operative engagement with the end articles to be removed from the stack, a stack retaining member mounted for shifting laterally into and out of operative engagement with the edge of the stack to prevent removal of the balance of the stack from the holding means when end articles are being removed therefrom, and a stack support member mounted for shifting laterally into and out of engagement with articles at the one end of the stack to prevent removal of the stack from the holding means when the stack retaining member is out of operative engagement with the edge of the stack, the lateral shifting of the stack support member into operative engagement including an increment of longitudinal motion toward the stack, drive means connected to operate the dispensing means through a cycle of motion to remove end articles from the one end of the stack including a prime motivator comprising a pair of telescopically associated members, an operating member mounted for to-and-fro longitudinal travel relative to the stack, means anchoring one of the telescopically associated members of the prime motivator to the holding means, and means connecting the other of the telescopically associated members to the operating member for driving the operating member longitudinally to-and-fro from the prime motivator, a first cam member mounted for longitudinal travel relative to the stack to control lateral shifting of the stripping finger member, a direct mechanical connection between the first cam member and the operating member to actuate the stripping finger member laterally in response to travel of the operating member, a second cam member mounted for longitudinal travel relative to the stack to control lateral shifting of the stack retaining member, a direct mechanical connection between the second cam member and the operating member to actuate the stack retaining member laterally in response to travel of the operating member, a third cam member mounted for longitudinal travel relative to the stack to control lateral shifting of the stack support member, a direct mechanical connection between the third cam member and the operating member to actuate the stack support member laterally in response to travel of the operating member, a lost motion connection between the finger support member and the operating member to actuate independent longitudinal travel of the stripping finger member in response to only a portion of the travel of the operating member, means connected to impart to the stripping finger member an increment of lateral shifting out of operative engagement with end articles removed from the stack in addition to the aforesaid shifting into and out of operative engagement with the articles to be removed from the stack, the drive means being connected to shift the stack retaining member and the stripping finger member laterally into and the stack support member laterally out of operative engagement during a first portion of the travel of the operating member in one direction before the lost motion connection is established, to generate independent longitudinal travel of the finger support member away from the end of the stack during a later portion of the travel of the operating member in the one direction while the lost motion connection is established, and to impart to the stripping finger member the increment of lateral outward shifting near the terminus of the independent longitudinal travel of the finger support member away from the stack during a final portion of the travel of the operating member in the one direction, and to control repositioning of the dispensing means during travel of the operating member back in the other direction to complete an article dispensing cycle.

2. An arrangement for dispensing articles as in claim 1 wherein the stripping finger member is shiftably mounted relative to the finger support member to provide the shifting laterally into and out of engagement with end articles to be removed.

3. An arrangement for dispensing articles as in claim 2 wherein the stripping finger member is mounted for rectilinear sliding motion in the finger support member.

4. An arrangement for dispensing articles as in claim 3 wherein the increment of lateral shifting out of operative engagement with end articles removed from the stack involves the rectilinear sliding motion of the stripping finger member relative to the finger support member.

5. An arrangement for dispensing articles as in claim 1 wherein the finger support member is mounted for concurrent shifting with the stripping finger member laterally into and out of engagement with end articles to be removed.

6. An arrangement for dispensing articles as in claim 5 wherein the stripping finger member and the finger support member are mounted for concurrent arcuate swinging motion relative to the stack.

7. An arrangement for dispensing articles as in claim 6 wherein the increment of lateral shifting out of operative engagement with end articles removed from the stack involves additional swinging of the stripping finger member relative to the finger support member.

8. An arrangement for dispensing articles as in claim 1 wherein the prime motivator comprises an electrically powered reciprocating device including means for controlling the velocity of reciprocation.

9. An arrangement for dispensing articles as in claim 1 wherein the prime motivator comprises a piston-cylinder type reciprocating fluid motor including means for controlling the velocity of reciprocation.

10. An arrangement for dispensing articles as in claim 1 wherein the dispensing means further includes a sensing finger member, means mounting the sensing finger member for to-and-fro longitudinal reciprocatory travel relative to the stack, a one way drive connection between the sensing finger member and the operating member to control travel of the sensing finger member longitudinally away from the stack, and a yieldable motivating device connected to generate travel of the sensing finger member longitudinally back toward the stack.

11. An arrangement for dispensing articles as in claim 10 wherein the one way drive connection between the sensing finger member and the operating member includes an abutment to directly cause longitudinal travel of the stack retaining member away from the stack which permits longitudinal travel of the sensing finger member away from the stack.

12. An arrangement for dispensing articles as in claim 10 wherein the one way drive connection between the sensing finger member and the operating member includes a cam to directly cause longitudinal travel of the sensing finger member away from the stack which permits longitudinal travel of the stack retaining member away from the stack.

13. An arrangement for dispensing articles as in claim 10 wherein the finger support member comprises an elongated member mounted for sliding motion in a support arm, one portion of the elongated member including one of the operative abutments of the lost motion connection, the stripping finger member being mounted for lateral shifting on the elongated member to provide the increment of lateral shifting out of operative engagement with end articles removed from the stack, means mounting the support arm for lateral shifting to provide the lateral shifting of the stripping finger member into and out of operative engagement with the end articles to be removed, a spring biasing the elongated member relative to the support arm back to the end of the stack,

the spring being overcome by the longitudinal travel away from the end of the stack while the lost motion connection is established, and means rendering the spring ineffectual when the lost motion connection is not established whereby the elongated member is freely slidable in the support arm.

14. An arrangement for dispensing articles as in claim **10** wherein the stripping finger member and the sensing finger member each include a pivotally mounted cross bar with laterally inwardly extending fingers at opposite extremities thereof.

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