United States Patent [19]

Strauss

[11] **3,771,649**

[45] **Nov. 13, 1973**

[54] **HYDRAULIC PRESSURE BOTTLE TESTING METHOD AND MACHINE**

[76] Inventor: **Leopold Strauss,** 18 Judith Ct., East Rockaway, N.Y. 11518

[22] Filed: **July 17, 1972**

[21] Appl. No.: **272,325**

[52] **U.S. Cl.** .... **209/74 R,** 209/75, 209/79, 198/30, 73/88 R, 73/94, 73/37

[51] **Int. Cl.** **B07c**

[58] **Field of Search** .... 209/75, 72, 73, 74, 209/79; 198/30, 22; 73/37, 94, 88 R; 241/99

[56] **References Cited**

UNITED STATES PATENTS

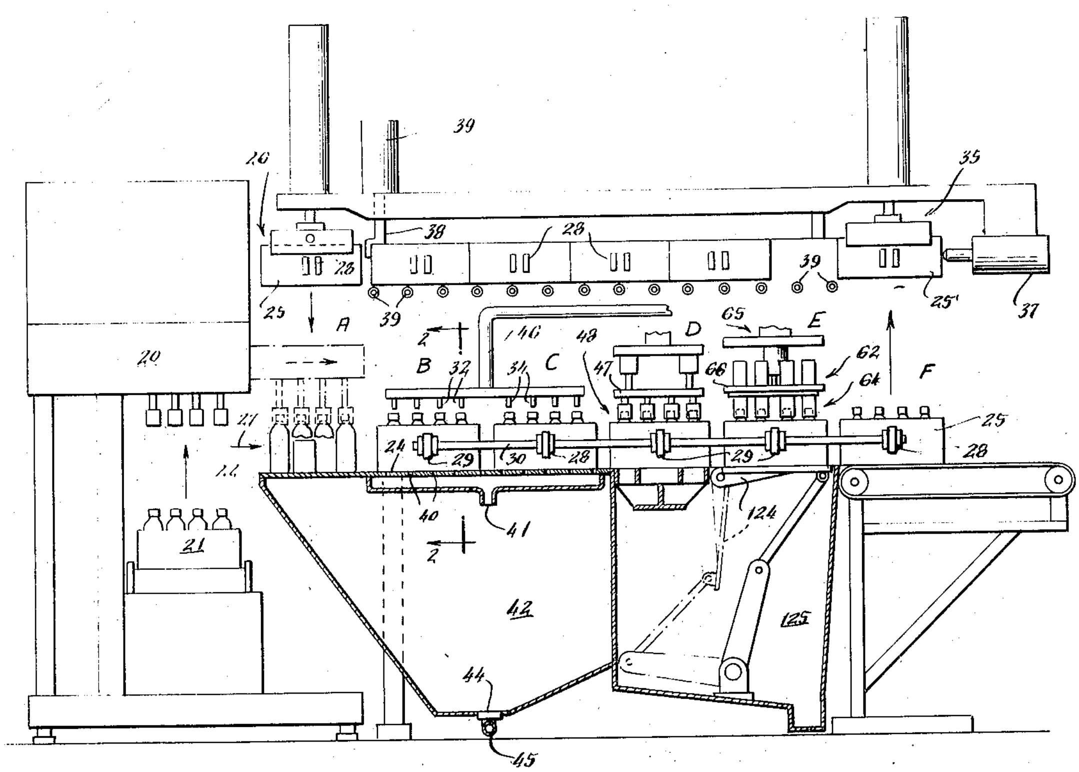
3,010,310	11/1961	Rowe	73/45.1 X
3,628,379	12/1971	Babunovic	209/79
3,650,146	3/1972	Babunovic	73/37
3,489,275	1/1970	Powers, Jr.	209/72

Primary Examiner—Allen N. Knowles
Attorney—Robert A. Buckles et al.

[57] **ABSTRACT**

Means are disclosed for automatically filling a group comprising a large number of empty bottles with fluid such as water, advancing the entire group of filled bottles to a first test station where an axial load comparable to capping pressure and internal hydraulic test pressure is simultaneously applied to the mouths of all bottles in the group, then advancing the previously loaded and pressure tested group of bottles to another station where the presence of any ruptured bottles is detected and such broken bottles are selectively disposed of by gravity drop through a trap door while sound bottles are retained by automatic hydrostatic selective chunks and advanced from the tester to a conveyor discharge. Excess water is captured in a tank below the test table, filtered and recirculated, while broken glass may be removed by a discharge.

19 Claims, 16 Drawing Figures



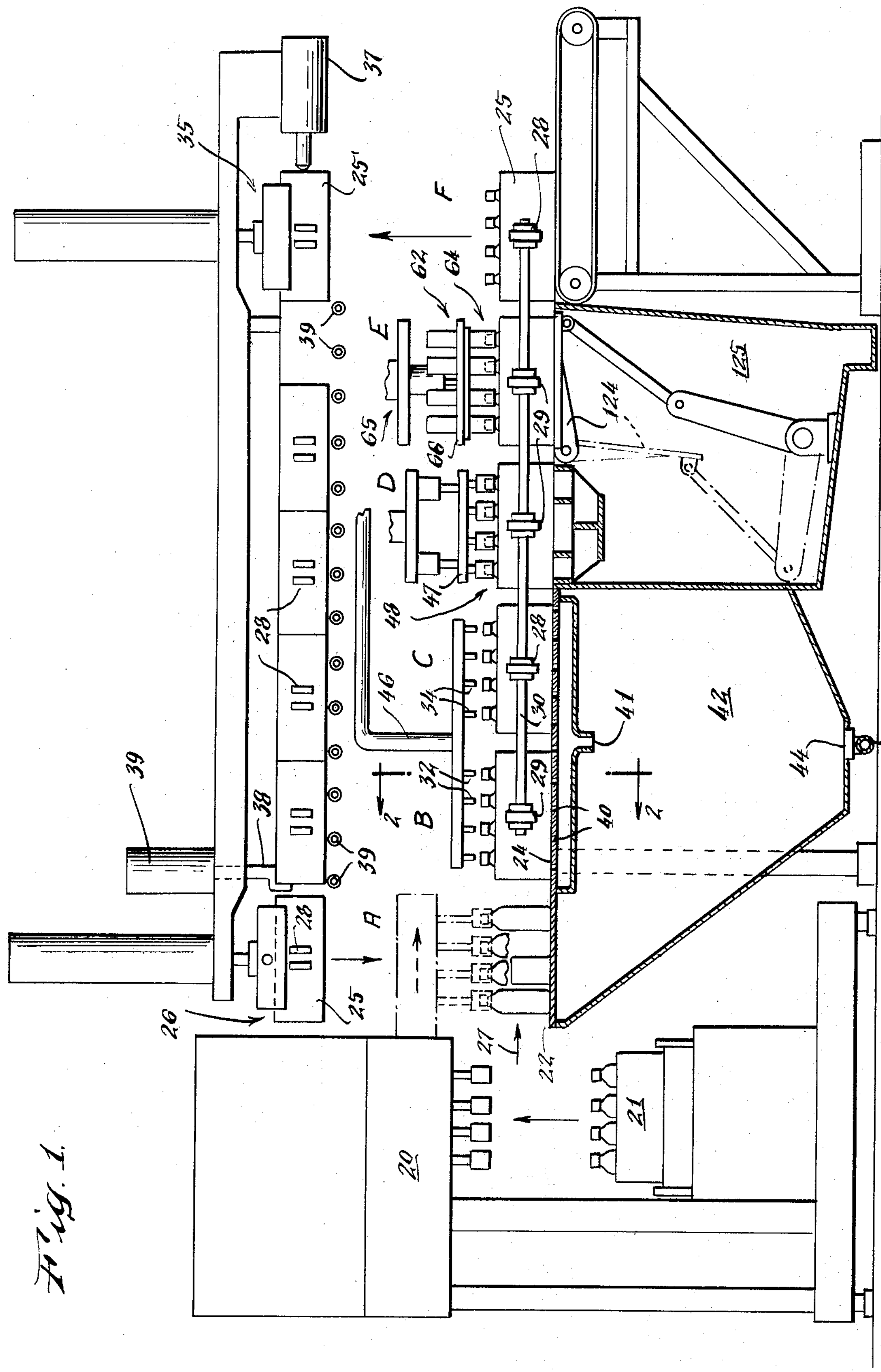


Fig. 1

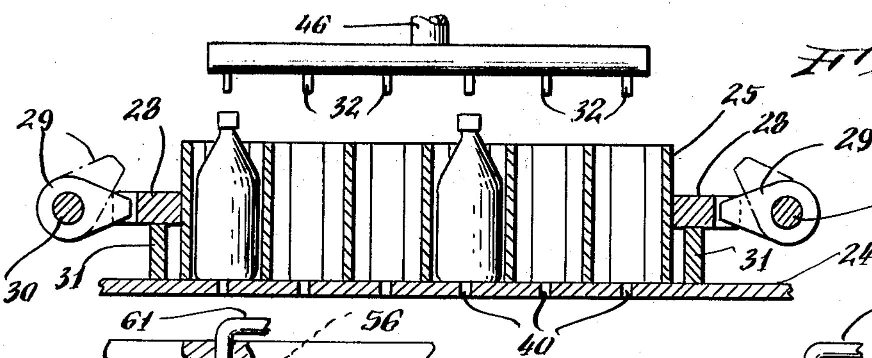


Fig. 2.

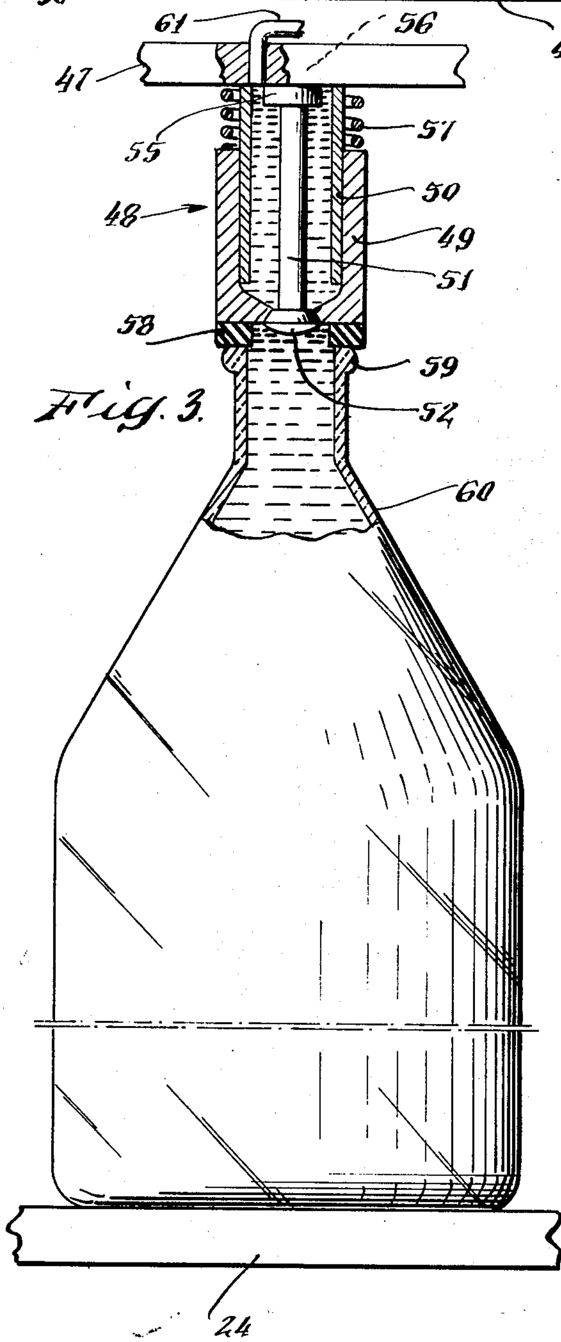


Fig. 3.

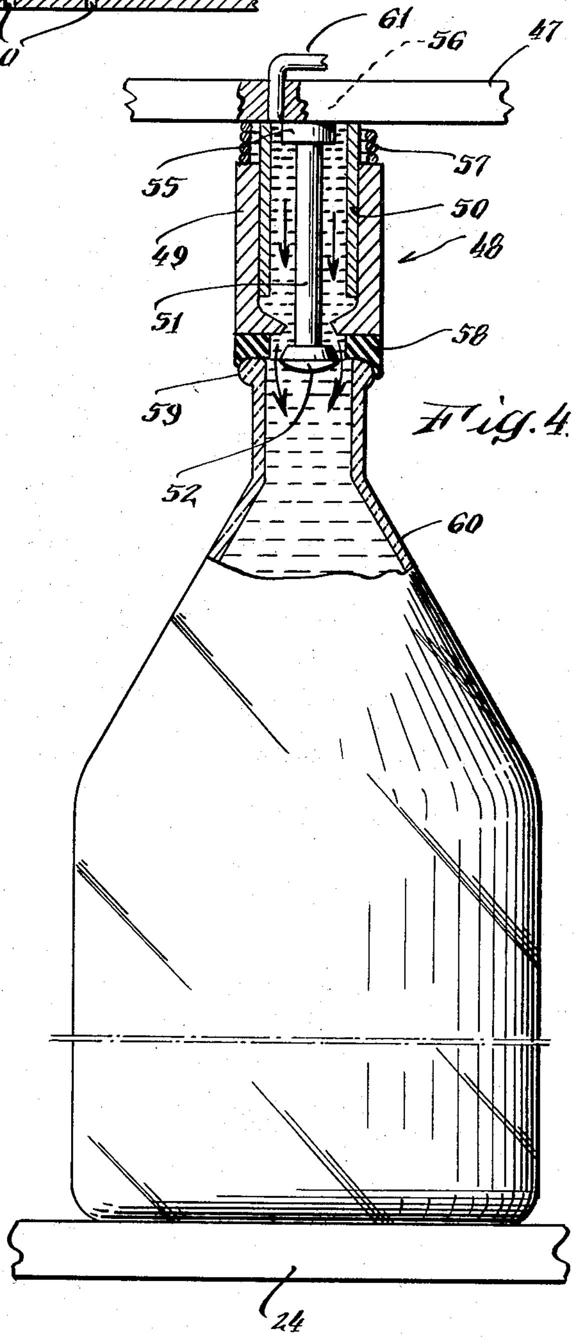


Fig. 4.

Fig. 5.

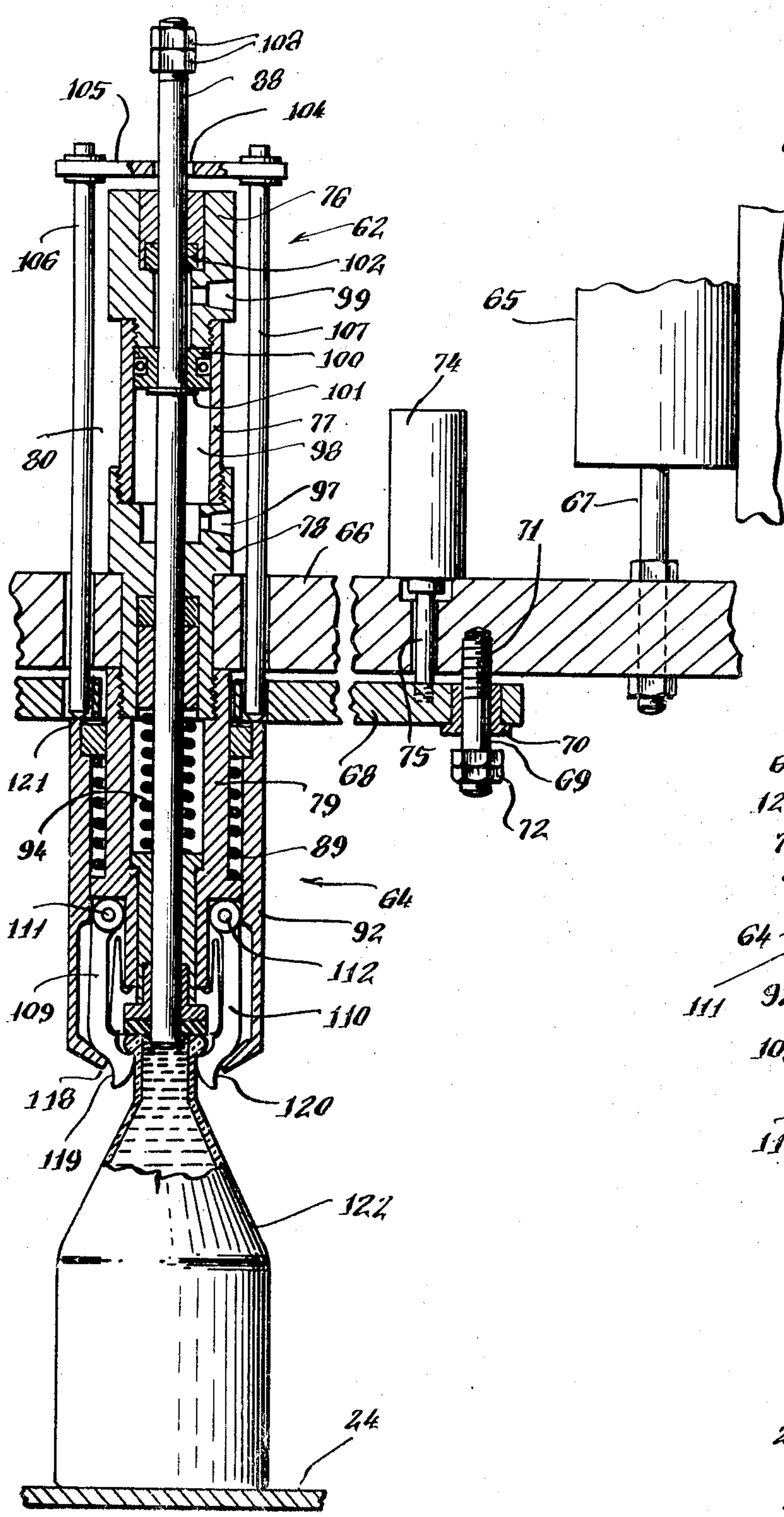
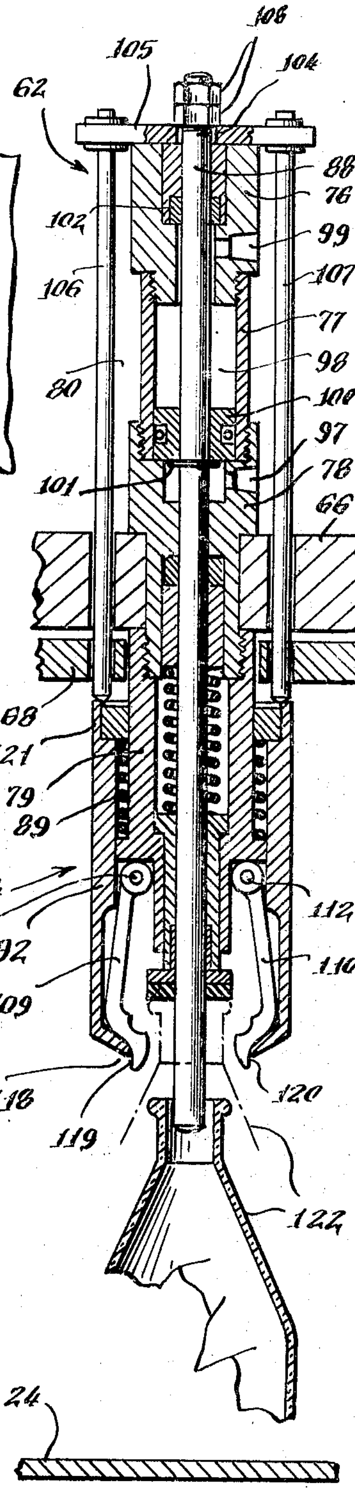

108
88
105
104
76
62
106
102
99
107
100
101
80
77
98
97
78
66
74
65
67
71
121
94
79
89
68
75
70
69
72
64
111
92
112
109
110
118
120
119
122
24

Fig. 6.


108
105
104
62
88
76
102
99
106
107
77
80
98
100
97
101
78
66
68
121
79
89
64
111
92
112
109
110
118
120
119
122
24

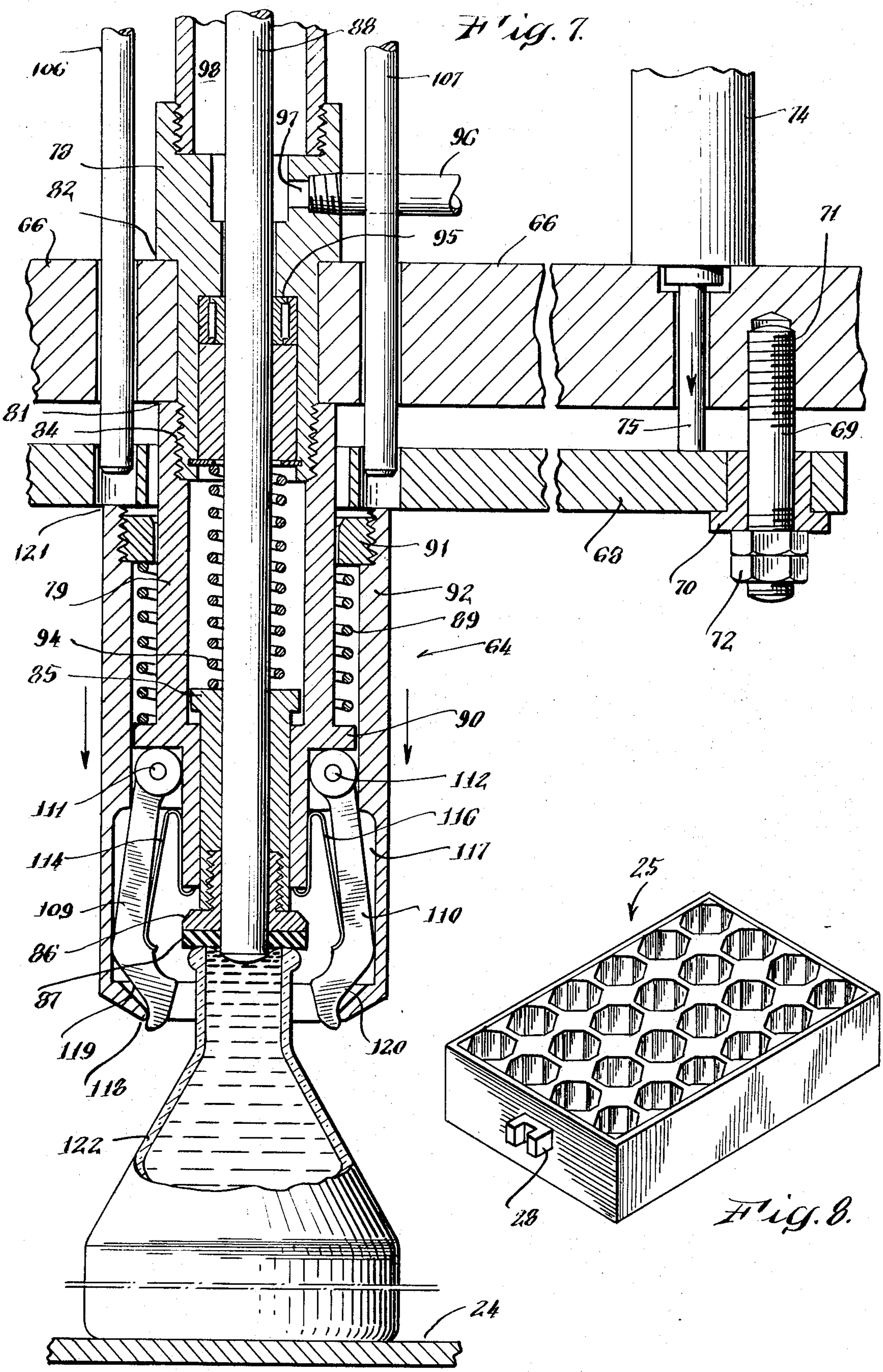

88
98
106
107
97
96
74
78
82
95
66
66
71
81
84
75
69
121
91
68
70
79
92
72
89
94
64
85
90
111
112
114
116
117
109
110
86
87
119
120
118
122
24
25
28

Fig. 7.

Fig. 8.

Fig. 9

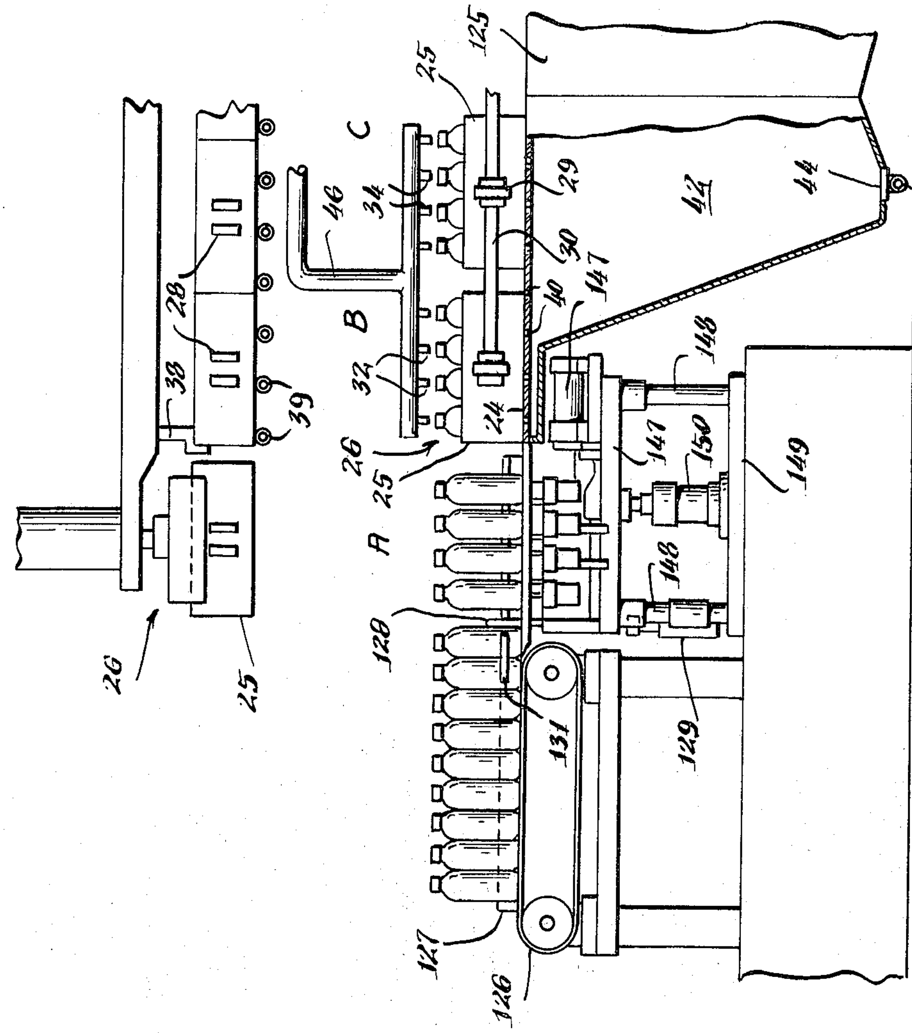


Fig. 15

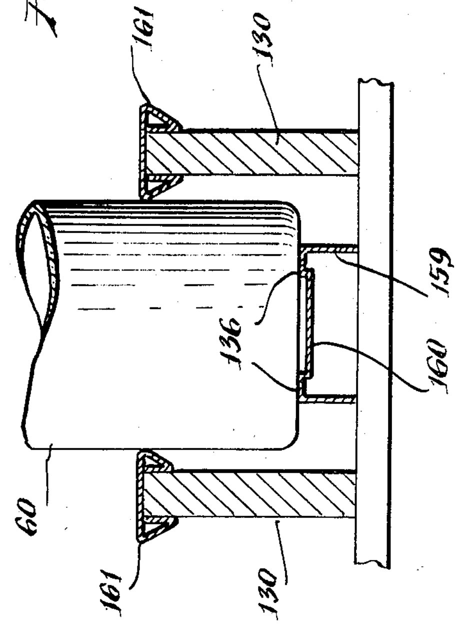


Fig. 16

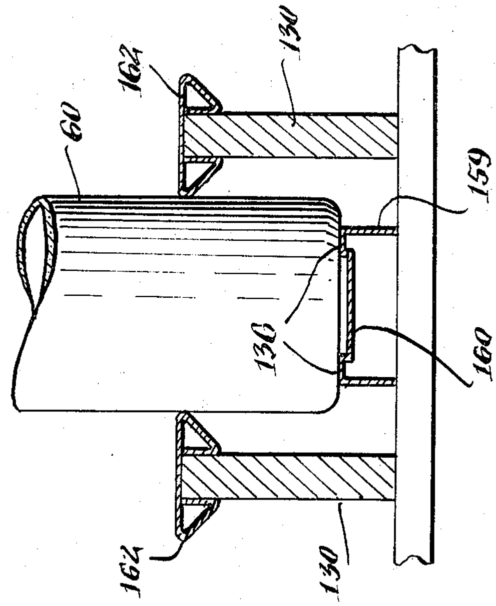


Fig. 10.

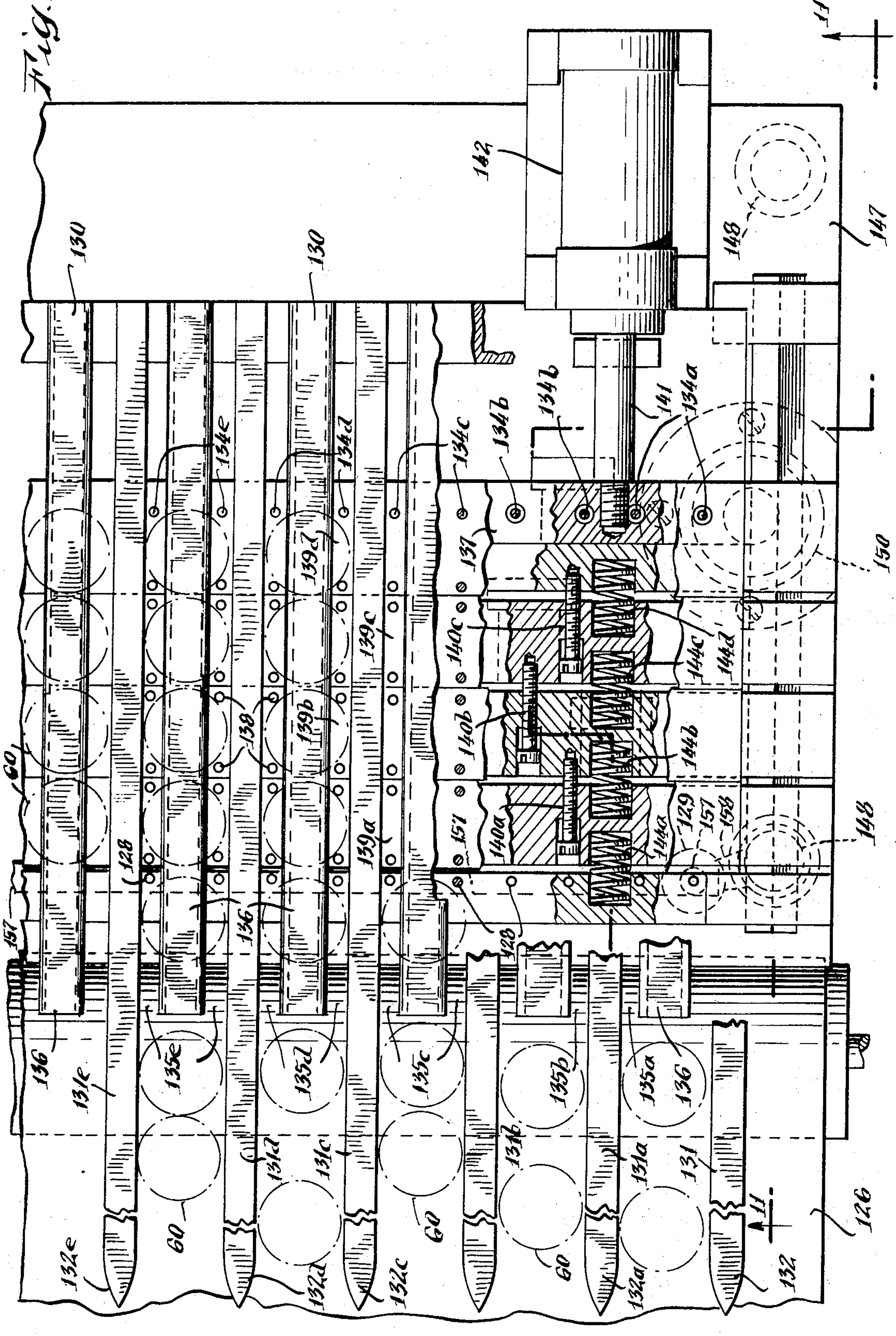
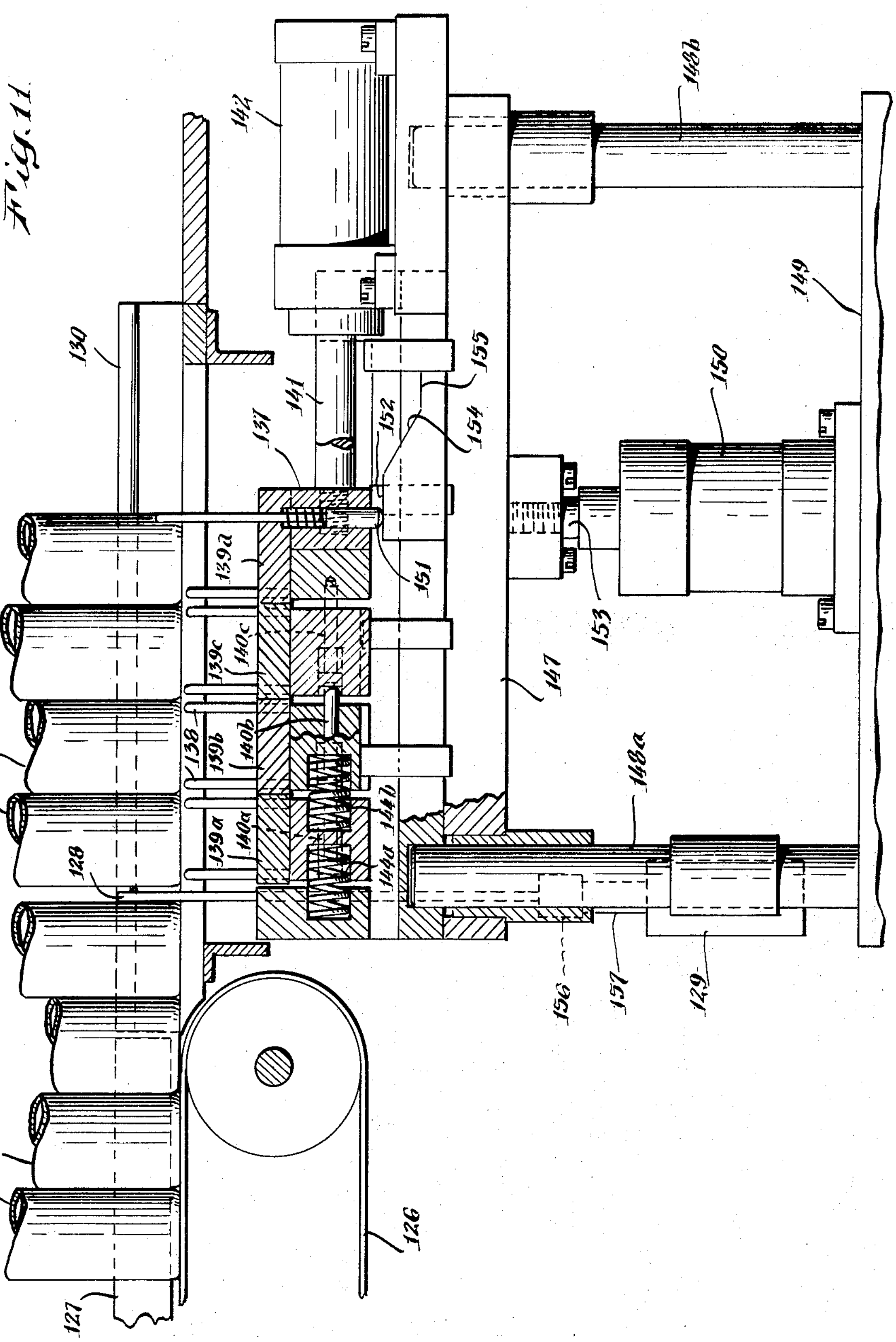


Fig. 11


142
148b
130
149
155
150
141
152
131
154
139a
151
153
139c
140c
147
138
139b
140b
60
144b
148a
139a
140a
144a
128
156
157
129
60
126
127

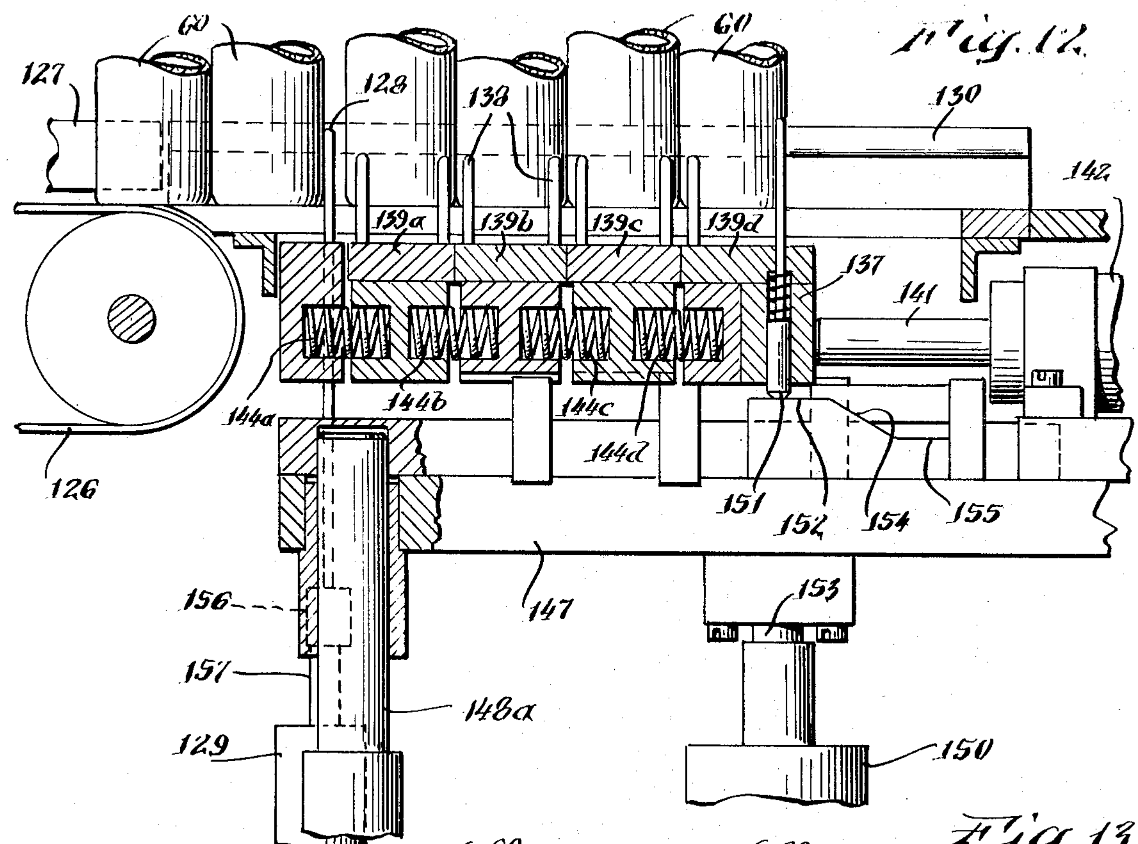

60
60
127
128
138
130
142
139a
139b
139c
139d
137
141
144a
144b
144c
144d
126
151
152
154
155
147
153
156
157
148a
129
150

Fig. 12.

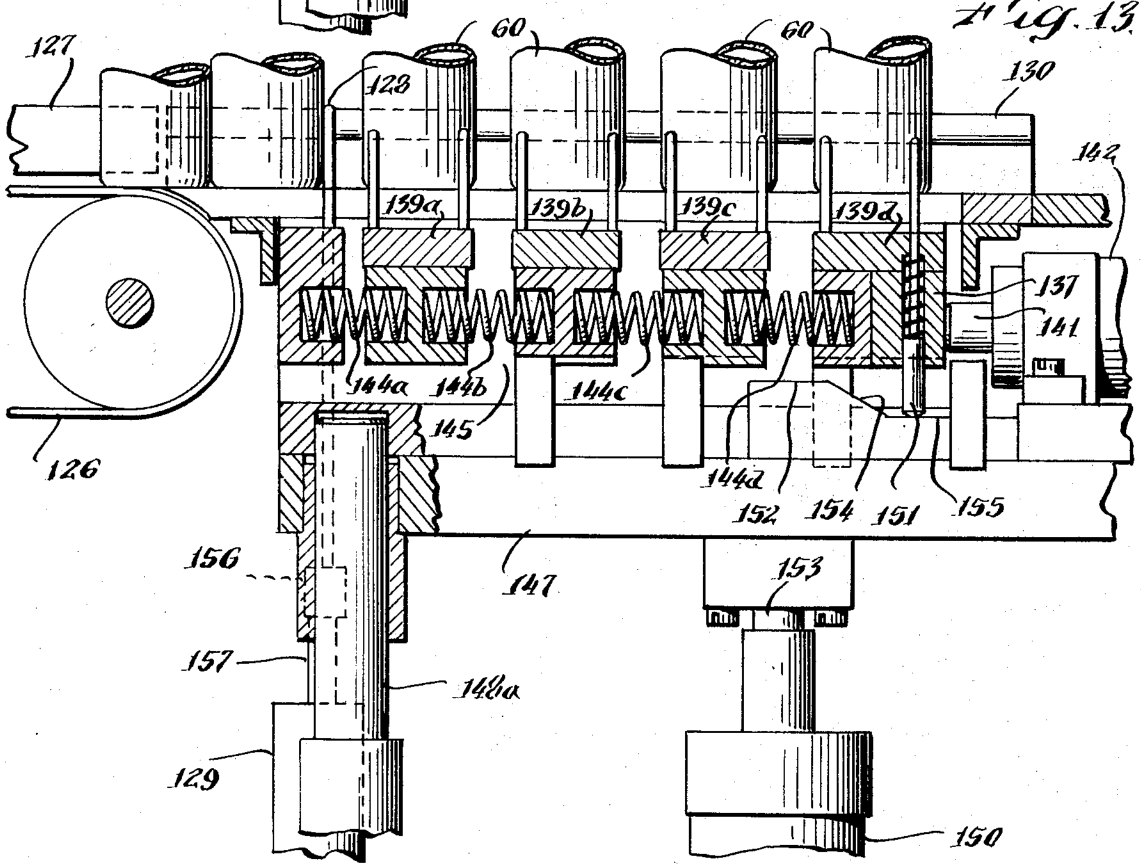
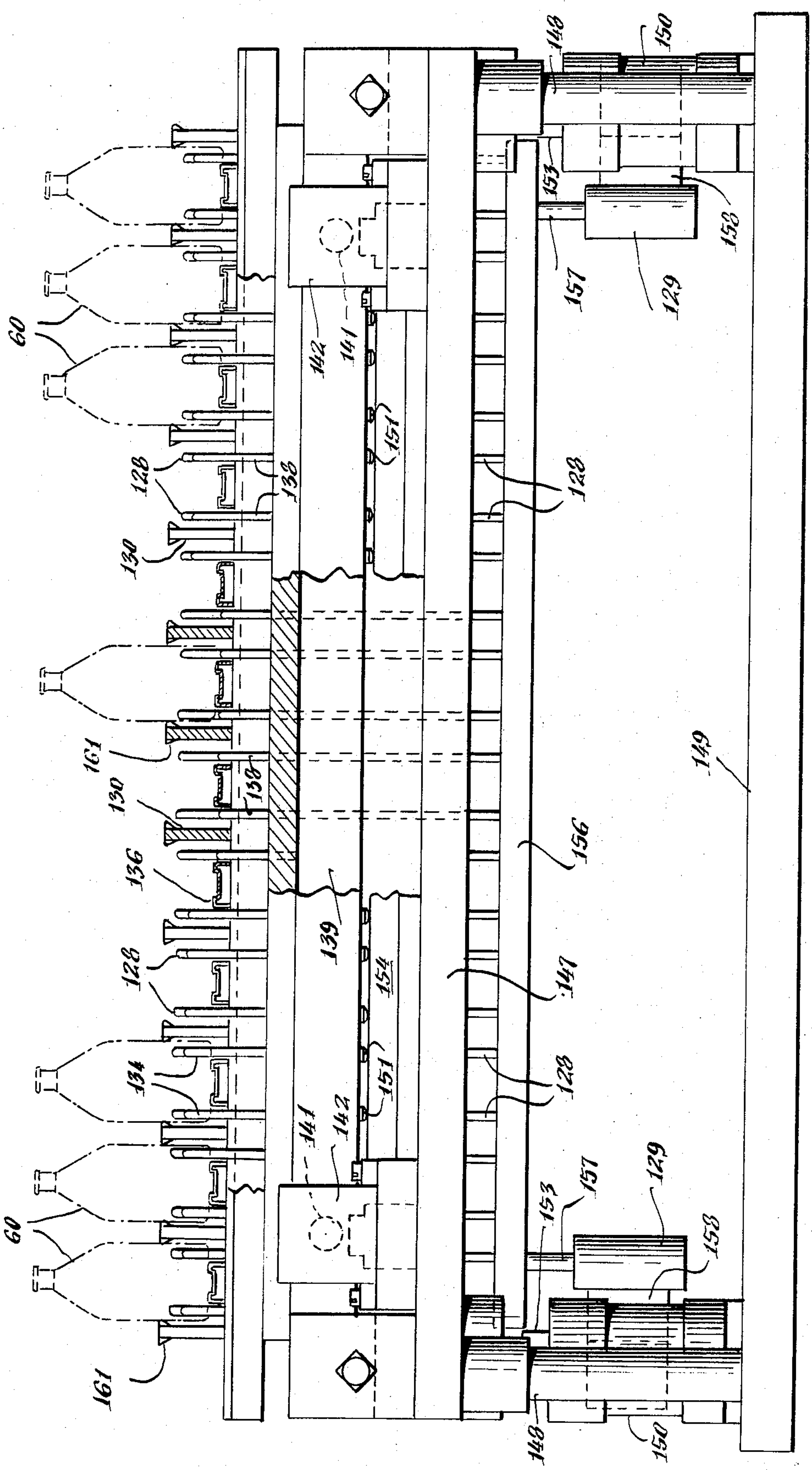

60
60
127
128
130
142
139a
139b
139c
139d
137
141
144a
144b
144c
145
144d
152
154
151
155
126
147
153
156
157
148a
129
150

Fig. 13.

Fig. 14.


60
128
138
130
161
130
138
136
139
128
134
141
142
154
151
147
156
128
149
142
141
151
157
153
129
158
148
150
161
60
157
129
158
153
148
150

HYDRAULIC PRESSURE BOTTLE TESTING METHOD AND MACHINE

The foregoing abstract is not to be taken either as a complete exposition or as a limitation of the present invention, and in order to understand the full nature and extent of the technical disclosure of this application, reference must be had to the following detailed description and the accompanying drawings as well as to the claims.

BACKGROUND OF THE INVENTION

In all bottling plants, and particularly those for carbonated beverages such as soft drinks or beer, it is necessary that bottles be tested for structural weakness before being filled with pressurized beverage. In the prior art generally it has been the practice to test bottles on a sample basis separately and individually, either by the application of pneumatic or hydrostatic pressure. In many prior art bottle testing operations it has been necessary for an operator to manually insert a bottle into a test station and visually observe whether the bottle withstands the applied pressure; and even in those systems designed for automatically feeding bottles into testing machines it has been necessary to have an attendant operator to remove defective bottles. In the prior art, bottles which have withstood internally applied test pressure may nevertheless be subsequently broken by the bottle capping machine which applies a substantial axial load in the process of affixing and crimping the bottle caps. One form of prior art automatic pressure tester for glass containers employs a rotary table test station into which a single line of bottles is fed by a conveyor and pneumatic pressure is automatically applied to individual bottles as they pass therethrough. Because of the explosive reaction of defective bottles subjected to pneumatic pressure it is necessary for the rotary table in such devices to be completely enclosed in a heavy steel casing and thoroughly sound proofed to reduce the explosive noise level. By the present invention employing hydrostatic as distinguished from pneumatic pressure testing I not only eliminate the hazards and noise of explosions but, even more importantly, provide means for automatically and simultaneously testing a large number of bottles, comprising as many as several case loads at once, whereby bottles are axially loaded and tested hydraulically at bottle filling line speeds. Bottles may be fed into the present tester by the case load from an uncaser, or in bulk from a pallet or conveyor belt. The present invention also includes means for uniformly spacing and accurately centering bottles to be tested, and for automatically moving groups of bottles through successive stages of the testing machine, thereby providing more rapid as well as safer and more efficient testing of bottles with minimal attention of a production line operator. Defective bottles in any group under test are automatically and selectively removed from the test lines without disturbing the remaining sound bottles. Furthermore, by simultaneously subjecting bottles to axial loading comparable to the axial forces applied by capping machines, they are automatically tested for axial loads as well as internal pressure integrity.

OBJECTS OF THE INVENTION

The object of the invention is, therefore, to provide a method and machine for more rapid axial and pressure testing of closed containers, such as bottles, wherein quantities of containers arranged in groups are simultaneously and automatically subjected to preselected axial loads and internal pressure, and defective containers are automatically and selectively disposed of without the intervention of a human operator, all at filling line speeds.

Another object of the invention is to provide such a pressure testing machine designed for continuous automatic operation.

A further object is to provide an improved bottle testing machine which is free from the hazards and noise of exploding defective bottles.

A more particular object of the invention is to provide method and means for axially loading and pressure testing glass containers hydraulically at bottle filling line speeds.

An overall objective is to provide method and means for assuring the delivery of sound bottles to a pressurized beverage bottling plant whereby consumers of pressurized beverages are protected from the hazard of explosion.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical front view of the apparatus of the invention in a first embodiment, with a portion of the carrier table and tank section therebelow cut away;

FIG. **2** is a vertical cross-sectional end view taken along the line **2—2** of FIG. **1**, showing a bottle carrier engaged with the linear transfer members;

FIG. **3** is a vertical detail in cross-section showing a test pressure head engaged with a liquid filled bottle before hydraulic pressure is applied;

FIG. **4** is a cross-sectional detail similar to FIG. **3** showing the test head fully depressed to apply hydraulic pressure;

FIG. **5** is a cross-sectional view of a broken bottle test head engaged with the mouth and neck of a bottle which has been subjected to internal hydraulic pressure by a test head as shown in FIGS. **3** and **4**;

FIG. **6** is a cross-sectional view of a test head similar to FIG. **5** but showing the release of a bottle tested thereby and found to be broken;

FIG. **7** is a cross-sectional view of the test head of FIG. **5** in the operation of releasing a sound bottle;

FIG. **8** is a perspective view of a honeycomb bottle carrier as employed in the apparatus of the invention;

FIG. **9** is a vertical front view, similar to FIG. **1**, of an alternative embodiment of the invention adapted for receiving empty bottles in bulk from a conveyor belt and for automatically grouping, spacing and centering a preselected quantity of bottles for movement through the pressure testing apparatus of the invention;

FIG. **10** is a horizontal top view of a portion of the input station of FIG. **9**, partially cut away, showing the mechanism for uniformly spacing and centering bottles at the input station of the embodiment shown in FIG. **9**;

FIG. **11** is a vertical cross-sectional view of the bottle spacing mechanism taken along line **11—11** of FIG. **10**;

FIG. **12** is a cross-sectional view similar to FIG. **11** but showing the progressive movement of the bottle centering platen to its uppermost position wherein individual bottle holding pins extend upwardly through parallel slots in the table top;

FIG. **13** is a cross-sectional view similar to FIG. **12** but showing further progressive movement of the bottle spacing mechanism wherein the several segments of the platen are fully extended to the right and the supporting pins have uniformly spaced the group of bottles in this longitudinal direction; and

FIG. **14** is a vertical end view of the bottle spacing and centering input station according to the embodiment illustrated in FIGS. **9–13**, showing the bottle centering pins fully retracted below the level of the test table top but with the forward gate stop pins remaining in elevated position.

SUMMARY OF THE OPERATION OF THE INVENTION

In the first embodiment disclosed by FIGS. **1** through **8** bottles may be initially fed into the apparatus of the invention from a standard "uncaser" as found in practically all bottling plants. The uncaser picks up 24 bottles at a time and deposits them onto the entrance apron of the testing machine. A honeycomb type of carrier tray, having 24 octagonal partitions, open at top and bottom, decends from an overhead conveyor and surrounds the bottles, centering them uniformly in equally spaced relation to each other.

A pair of parallel horizontally disposed reciprocating conveyor arms engages lugs on opposite sides of the carrier tray and slides the carrier and its bottles from the entrance apron into a first fill position under 24 gravity fed water spouts which rapidly pour water into each bottle. After a brief pause at the first fill position the bottles are substantially but not completely filled with fluid. The linear conveyor then moves the carrier and its case of bottles under a second set of adjacent water spouts which complete the filling operation at a reduced rate of flow, topping off each bottle with a minimum of overflow spillage. Excess water flows through holes in the table beneath the bottles and into a clean water tank from which it is recirculated to the filling spouts.

As the first carrier tray is moved into the second fill station, a succeeding tray is also moved simultaneously under the first filling spouts by the same linear conveyor mechanism so that the operation, though employing intermittent motion, is nevertheless continuous. By virture of the recycling water pump, water may flow continuously from all the filling spouts thus eliminating any need for liquid valving.

The linear conveyor next moves the completely filled group of bottles in their carrier under a test pressure station comprising a vertical press section having 24 hydraulic pressure heads. The pressure heads come down simultaneously onto the top of the bottles, in sealing engagement with the mouth of each bottle, and automatically apply both an axial force comparable to a capping operation and a preselected hydraulic pressure as desired, for a specified time, after which all the pressure heads are lifted and the bottle carrier is transported to the next position under a broken bottle test head. This station is also a press section at which

twenty-four heads come down into sealing engagement with the mouths of the bottles, each head inserts a preloaded plunger into its bottle through the seal, and if pressure maintains between the head and bottle a chuck clamps around the bottle neck. If pressure is not maintained between the head and bottle, as will occur if the bottle is split or has a broken sidwall, the test plunger will move down its full stroke, thereby disengaging the chuck and releasing the bottle.

A trap door in the test table under the bottle carrier at this last station is then automatically opened and any broken bottles fall therethrough into a cullet water tank, since their corresponding chucks are maintained open. The trap door is then closed, the pressure heads and chucks are released and lifted. Before the trap door is opened the pressure behind the test plungers is relieved so that the chucks carry only the weight of the filled bottles and not the plunger load.

On the next index transfer cycle of the linear conveyor, the carrier and its remaining fully tested bottles are moved onto an exit conveyor belt while a carrier elevator engages the carrier to lift it up from the bottles to an overhead track from whence it is returned to the starting position, while the tested bottles are transported by the conveyor belt into a rinser, or are delivered to a bottling machine.

ALTERNATIVE EMBODIMENT

In the second embodiment, disclosed by FIGS. **9** through **14**, the operation of the fill stations, pressure heads, fluid displacement test heads and selectively releasable bottle chucks remains substantially the same as in the first described embodiment. However, as this alternative embodiment of the invention is adapted to receive bottles in bulk rather than from an uncaser, it is capable of testing larger groups of bottles and of delivering proven sound bottles at an even faster rate.

The input station of this embodiment of the invention receives bottles in bulk, disposed in upright position but in random order, on a continuously moving conveyor belt and it must align selected groups of bottles (each group may comprise several cases) in uniform horizontal spacing with accurate centering so that the mouth of each bottle is correctly positioned beneath the pressure test heads. Laterally disposed spacer bars fixed above the input station table top separate the bottles into a plurality of parallel linear rows as the conveyor belt moves thereunder. Vertically movable stops at the downstream end of the input table initially limit the movement of bottles in this direction while similar vertically moveable stops rise at the upstream end of the input table to restrain oncoming randomly dispersed bottles on the conveyor belt from entering the input table when all rows between spacers have been filled. The input table top surface on which the rows of adjacent bottles now rest is provided with a plurality of laterally extending linearly slidable blocks, of approximately the same width as the bottle's diameter, which are next moved linearly to provide uniform linear separation between adjacent bottles in each row, thus effecting uniform separation of all bottles of the group in two directions, in a rectilinear grid pattern as viewed from above. With the selected group of bottles thus arranged, a honeycomb open bottom conveyor case descends from an overhead carrier and surrounds the entire group of uniformly spaced bottles for controlled movement of the group under the filling heads, and thence under the pressure test heads and selectively operable chucks in the same manner as employed in the first embodiment of the invention.

DETAILED DESCRIPTION

Referring now in greater detail to FIG. 1 of the drawings, which shows a vertical side view of the simpler of two illustrative embodiments, an uncaser illustrated generally at **20** receives a succession of cases of empty containers such as at **21** and successively lifts and deposits each case load onto the input apron **22** of a horizontal test table **24**. A bottle carrier such as **25**, which is open at its top and bottom and partitioned with a plurality of honeycomb divider walls (as shown in perspective by FIG. **8**) is lowered by an overhead conveyor mechanism indicated generally at **26** over the tops of and around the case load of upright bottles **27** now standing on the entrance apron **22** of test table **24**. Each bottle carrier such as **25** has on its opposite ends a pair of lug engaging ears **28** (as also shown in perspective by FIG. **8**), which are engageable with rotatable lugs **29—29** (FIG. **2**) on horizontally reciprocating conveyor shafts **30—30**.

Referring now more particularly to FIG. **2** of the drawings it will be seen that the bottle carriers such as **25** are guided longitudinally between two parallel guide rails **31—31** which are mounted upon and extend the length of the test table top **24**. Lug ears **28—28** protrude over the top of guide rails **31—31** and engage with lugs **29—29** on conveyor shafts **30—30** when the lugs **29** are in their horizontal position as shown in solid lines in FIG. **2**. A reciprocating mechanism (not shown) moves the conveyor shafts **30—30** longitudinally (from left to right in FIG. **1**) a distance equal to the spacing between adjacent lugs **29—29** on shafts **30—30**; then the conveyor shafts **30—30** are rotated through approximately 45° to disengage the lugs **29** from the ears **28**, as shown by broken lines in FIG. **2**, and the shafts **30—30** are then reciprocably moved in the opposite direction (from right to left in FIG. **1**) the same distance and the lugs **29** are again rotated into their horizontal position as shown by solid lines in FIG. **2** to engage the ears **28** of the next adjacent carrier **25**.

In this manner each bottle carrier is moved successively, as shown in FIG. **1**, from the input station A where bottles and carrier are resting upon input apron **22**, to station B where each bottle in the carrier is positioned beneath a "fast fill" water spout **32**, thence on the next reciprocating stroke of conveyor shafts **30** to position C where each bottle is beneath a "slow fill" spout to "top off" the filling of all bottles, thence to station D where an axial load and internal fluid pressure test is performed, thence to station E where broken bottles are discarded, and finally to station F where the carrier **25** is lifted by vertically reciprocating elevator mechanism **35**, and the tested and proven sound bottles are deposited on a conveyor belt **36** which may transport them to a bottling machine. A piston operator **37** "kicks" or pushes the elevated carrier **25'** from the jaws of lifting mechanism **35** onto the rollers **39** of an overhead inclined roller track whereby empty carriers are recirculated by gravity to a starting gate **38** which is raised at regularly timed intervals by an overhead piston operator **39** to allow the front carrier to enter the closed jaws of carrier lowering mechanism **26**.

Referring once again to FIG. **2** of the drawings, the portion of the test table **24** beneath the liquid fill stations B and C is provided with a plurality of openings **40** which allow excess water from fill spouts **32** and **34** (FIG. **1**) to flow through the table top into a large funnel **41** therebeneath and thence into a clean water collection tank **42** from whence this water passes through a bottom drain **44** and connecting pipe **45** to a recirculating pump (not shown) into fill pipe **46**. Still referring to FIG. **1**, the fill spouts **32** at first fill station B have largely unrestricted openings to allow rapid substantial filling of bottles at this station, while fill spouts **34** at the second fill station, C, are provided with more restricted openings to facilitate toping off the filling of all bottles with a minimum of splashing and excess water overflow. As the water flowing from spouts **32** and **34** may run continuously during the operation of the machine, no liquid valving is required.

From the final fill station C (FIG. **1**) the carrier **25**, with its bottles filled to their very tops with water, is advanced to pressure test station D where a hydraulic press platen indicated generally at D, carrying the same number of hydraulic pressure valves **48** as there are bottles in the carrier, is brought down forcefully into pressure sealing engagement with the open tops of all the glass containers thereunder. The details of construction and operation of the hydraulic pressure valves **48** will now be described with particular reference to FIG. **3** and FIG. **4** of the drawings.

Referring first to FIG. **3**, each of the hydraulic pressure test valves indicated generally at **48** comprises an outer cylindrical sleeve **49** slidably mounted on an inner cylindrical sleeve member **50** the upper end of which is joined to the bottom surface of platen **47**. A central valve stem **51** within inner cylinder **50** has a valve head **52** formed on its lower end which normally rests in sealing engagement with a valve seat **54** formed within the lower end of outer cylinder **49**. A flange **55** formed on the upper end of valve stem **51** abuts the bottom surface of platen **47** and the valve stem **51** is thereby securely mounted on platen **47** through a threaded end **56**. A helical compression spring **57** surrounds cylinder **50** to apply downward pressure between platen **47** and outer sleeve **49**, thereby normally maintaining closed sealing engagement between the mating surfaces of valve head **52** and valve seat **54**. An annular ring **58** of resilient material such as rubber or plastic is secured to the bottom end of outer cylinder **49** to provide pressure tight sealing engagement with the mouth **59** of a glass container such as bottle **60** when the valve head **48** is brought down upon the glass container by downward movement of platen **47**. A hydraulic pressure line **61** is passed through platen **47** to deliver high pressure fluid into the hydraulic valve head **48**. Thus FIG. **3** illustrates the condition as valve head **48** makes initial contact with the mouth **59** of bottle **60** upon partial downward movement of press platen **47**, with the valve **52–54** still clsoed under the force of compression spring **57**.

Referring next to FIG. **4**, the condition of full depression of press platen **47** is illustrated. Here the spring **57** is substantially fully compressed against the collar of outer sleeve **49**, the outer cylindrical sleeve **49** has moved upwardly away from valve head **52** to open the valve and admit the full hydraulic test pressure into bottle **60** as indicated by the arrows, and the mouth **59** of bottle **60** has compressed annular ring **58** to apply a substantial axial mechanical load upon the bottle **60** under test. If the bottle **60** has any defects in its manufacture, such as a thin wall or intolerable air bubble in the glass, or if it has sustained a crack in handling or structural stress during cooling or annealing it will now break under the combined influence of the applied internal pressure and the axial load imparted by the downward force the press platen **47.** Immediately upon structural failure of the bottle **60,** due to any of many possible defects, internal pressure is lost and the compression spring **57** drives the outer valve sleeve **49** downwardly to close the hydraulic pressure valve between valve stem head **52** and valve seat **54.** It should be borne in mind that this testing operation is performed simultaneously on a plurality of bottles, inasmuch as there are provided as many test heads **48** as there are bottles positioned under platen **47** at test station D in FIG. **1.**

Referring once again to FIG. **1** of the drawings, after completion of the test operation as described above, the test platen **47** carrying the plurality of test heads **48** is raised from engagement with the tested bottles and the reciprocating linear conveyor **30** is again moved to the right to transport the carrier **25** from test station D to disposal station E. Any broken bottles from the testing at station D remain in their honeycomb compartments of the carrier **25** and are moved along with sound bottles to station E, where a second press platen indicated generally at **62,** carrying a plurality of bottle gripping chucks indicated generally at **64,** is brought down by a vertically operating hydraulic piston, indicated generally at **65,** to cause all of the chucks **64** to surround the necks of bottles remaining upstanding in carrier **25.** The detailed operation of platen **62** (which actually comprises two separately moveable platen plates) and chucks **64** will now be described with reference to FIG. **5,** FIG. **6** and FIG. **7** of the drawings.

Referring now to FIG. **5** the details of construction and operation of the chucks **64** will be described in the first case when they encounter a sound bottle which has passed the dual tests applied previously at station D. An upper platen **66** mounted on and supported by a piston shaft **67** of vertical piston operator **65,** and moveable vertically thereby, carries beneath it a secondary platen **68** which is mounted in a parallel plane to platen **66** on a plurality of vertical studs **69** slidably passed through bushings **70** and secured to the under side of platen **66** as by end screw threads **71.** A header end, or a pair of lock nuts **72,** affixed to the lower end of the studs **69** limits downward motion of secondary platen **68** with respect to the position of upper platen **66.** A second vertical piston operator **74** mounted on platen **66** has a vertically moveable piston shaft **75** passing through a concentric vertical hole in platen **66** and secured to platen **68** as shown in FIG. **5.**

Referring now particularly to FIG. **7** of the drawings, the bottle chucks indicated generally at **64,** of which one is shown in detail (partially in section) by FIGS. **5, 6** and **7,** comprise a fixed central core portion indicated generally as **80** which may be assembled from four concentric cylindrical members, **76, 77, 78** and **79** as shown in FIGS. **5** and **6,** passed through platens **66** and **68** and rigidly secured to upper platen **66** by annular shoulders **81** and **82.** Shoulder **81** is formed by the upper end of cylindrical member **79** while shoulder **82** is formed on member **78** and these two parts are securely held together in locking engagement with platen **66** by screw threads **84.** Within a cylindrical coaxial bore in the bottom end of member **79** a hollow cylindrical plunger **85** is slidably mounted. An annluar bushing **86** threadably secured to the bottom end of plunger **85** has a resilient annular sealing member **87** affixed thereto with an elongated vertically slidable shaft **88** passing through an axial opening therein, as shown in each of FIGS. **5** through **7.** A helical compression spring **89** surrounds member **79** and is compressed between annular shoulder **90** formed on member **79** and an annular ring **91** threadably mounted in the upper end of an outer cylindrical member **92.** An inner concentric helical spring **94** around elongaged plunger **88** is held in compression between the upper annular end of hollow cylindrical plunger **85** and the lower end of member **78.** Packing means **95** within the bore of cylinder **78** forms a pressure tight slidable bearing for vertical plunger shaft **88** to prevent loss of operative fluid pressure introduced through pressure line **96** and port **97** into cylinder **98.**

Referring once again more particularly to FIG. **5** and FIG. **6** of the drawings, an upper pressure port **99** is provided in member **78** for the admission of operative pressure fluid to the top side of piston **100** which is secured to shaft **88** by a locking ring **101.** An upper packing seal **102** provides a pressure tight upper slidable bearing for shaft **88** within cylindrical member **76.** Shaft **88** passes freely through an opening **104** in a header yoke **105** which is mounted on the upper ends of a pair of chuck operating rods **106** and **107.** A pair of lock nuts **108** affixed to the upper end of shaft **88** are adapted to engage header **105** when shaft **88** is driven downwardly by operation of piston **100** and thereby to drive rods **106** and **107** downwardly against the upper end of outer cylindrical sleeve **92,** against the force of compression spring **89,** as shown in FIG. **6.**

As shown in FIGS. **5** and **6,** and more clearly in the enlarged view of FIG. **7,** a plurality of bottle gripping fingers **109** and **110** are pivotally mounted on the lower end of inner cylindrical member **79** at pivots **111** and **112,** and are normally biased to swing outwardly by bent leaf springs **114** and **116** into an enlarged annular cavity **117** formed within the lower end of outer sleeve **92.** An inward turned annular shoulder **118** formed on the bottom open end of sleeve **92** is adapted to engage sloping cam surfaces **119** and **120** of fingers **109** and **110** and to move these fingers inwardly into bottle gripping position when sleeve **92** is in its uppermost position as shown in FIG. **5,** and to allow fingers **109** and **110** to swing outwardly under the influence of springs **114** and **116** into bottle releasing position when sleeve **92** is in its lowered position as shown by FIG. **6** and FIG. **7.** As also shown by reference to FIG. **6** and FIG. **7,** the outer sleeves **92** of the bottle chucks indicated generally at **64** may be moved downwardly into their open position either by downward motion of secondary platen **68** with respect to primary platen **66** through operation of piston **74** to extend piston shaft **75,** thereby causing the lowered platen **68** to engage the annular shoulder **121** of sleeve **92** (as shown in FIG. **7**), or by depression of rods **106** and **107** through the downward action of piston **100.** During the initial lowering of all the hydraulic pressure test valves **64** (FIG. **1**) at station D the piston shaft **75** of piston operator **74** is in its extended position and all of the chuck fingers such as **109** and **110** are in their open position to allow the gaskets **87** to sealingly engage the mouths of all bottles positioned thereunder. During the movement of the test heads into this downwardmost position a controlled fluid pressure is maintained through port 97 to hold piston 100 and shaft 88 in their uppermost positions as shown in FIG. 5. Immediately after attaining sealing engagement of all the gaskets such as 87 onto the mouths of bottles at station E (FIG. 1), piston operator 74 is operated to retract piston shaft 75 and to raise secondary platen 68 whereby all of the chuck sleeves such as 92 are raised under the influence of helical compression springs such as 89 to close the bottle gripping chuck fingers as shown in FIG. 5. Next in sequence the test pressure is transferred from all the lower ports such as 97 to the upper ports 99 (FIG. 5 and FIG. 6), thereby applying downward force to pistons 100 and shafts 88 of all the test heads at station E (FIG. 1). All of the sound bottles which have withstood the internal hydraulic pressure and axial loading previously applied at station D, such as bottle 122 in FIG. 5, remain filled with water and, because of the pressure tight seal between gasket 87 and the mouths of the bottles such as 122, the shafts 88 are prevented from moving downwardly into the mouths of the sound bottles. However, in the event that a bottle under any test head 64 has broken, cracked or otherwise failed to remain filled with water following the application of internal pressure and axial loading at station D, then the plunger shaft 88 is free to move down as shown in FIG. 6 until the lock nuts 108 on its upper end engage yoke 105 to drive down rods 106 and 107 whereby sleeve 92 is depressed into its chuck opening position and the defective bottle is released.

At this stage of operations a trap door 124 (FIG. 1) in the test table top 24 beneath station E is opened, as shown by broken lines in FIG. 1, and all the defective bottles fall therethrough into a broken glass compartment 125. Thereafter trap door 124 is again closed, piston 74 is again operated to move secondary platen 68 downwardly whereby all of the chuck sleeves which have not been previously operated by pins 106–107 are now moved down to open all the bottle gripping fingers 109–110, as shown in FIG. 7. With all the chucks now disengaged piston 65 (FIG. 1 and FIG. 5) is operated to raise platens 66 and 68 in concert, and reciprocating horizontal conveyor 30 moves the carrier 25 and its proven bottles from station E to station F as shown in FIG. 1. Next the carrier lift mechanism 35 is lowered to engage the carrier 25 at station F and to lift the carrier from the tested bottles on conveyor belt to the overhead track 39 whence it eventually recirculates to the starting position at station A. Meanwhile horizontal reciprocating conveyor 30 again disengages all carriers 25 on test table 24, indexes to the left one full stroke (i.e., the distance between adjacent carriers at stations A through E), latches onto another carrier full of empty bottles at station A and thereafter reciprocates a full stroke to the right (as shown in FIG. 1) to advance all carriers on the test table to their next station.

DETAILED DESCRIPTION OF ALTERNATIVE EMBODIMENT

Reference is now had to FIG. 9 of the drawings which represents a vertical front view, partially cut away, of an alternative input station A for a bottle testing system and machine according to the present invention. In this embodiment the construction and operation of the remaining portion to the right of station A in FIG. 9 remains substantially as described hereinabove with reference to FIG. 1 through FIG. 8. The principal difference in this alternative embodiment is that instead of utilizing an uncaser to successively deposit case loads of empty bottles onto the entrance apron at station A, bottles are received in bulk, as randomly placed on a continuously mvoing conveyor belt 126. Bottles placed on the conveyor belt 126 in upright position are contained thereon by a pair of parallel side rails of which only the rear one 127 is shown in FIG. 9. A plurality of entrance gate pins 128 extend vertically through the leading edge of the entrance apron table surface at station A and are operated upward and donwwardly by an entrance gate cylinder 129 beneath the table at station A. A plurality of parallel linear separator bars 130 extend from right to left, as shown in FIG. 9, parallel to the table top surface at input station A, above the table surface and over the exit or downstream end of conveyor belt 126 as indicated at 131.

Referring now to FIG. 10, which is an enlarged top plan view of input station A (partially cut away), the means for uniformly spacing and centering bottles in this embodiment will be described in greater detail. Linearly extending spacer bars such as 131 through 131e as shown in FIG. 10 are tapered toward a smoothly rounded point at their upstream (left) ends as shown at 132 through 132*e*, whereby bottles being transported on conveyor belt 126, which moves from left to right as shown in FIG. 9 and FIG. 10, are caused to enter into the spacers between spacer bars 131–131*e* and thus are aligned in uniformly spaced linear columns upon the entrance table surface at station A (FIG. 9). A pair of donwstream gate pins such as 134a through 134e at the righthand end of the entrance table protrude upwardly through parallel slots 135*a* through 135*e* in the entrance table surface 136, which is conveniently formed of a plurality of equally spaced parallel flat bars having their top surfaces all mounted in a common plane. Gate pins 134*a* through 134*e* are rigidly mounted on a vertically moveable rod 137 which extends laterally beneath the table surface 136 and is actuated up or down by mechanism which will be described hereinafter with reference to FIG. 11. Groups of four equally spaced bottle retaining pins, such as 138 in FIG. 10, are mounted on adjacent laterally extending slidable blocks 139*a* through 139*d* beneath the table surface 136 and are extendable upwardly through slots 135*a*–135*e*. The four laterally extending, linearly slidable blocks 139*a*–139*d* are connected to each other by extensible linkage such as counterbored socket screws 140*a*, 140*b*, and 140*c*, while the righthand end block 139*d* is connected to a linearly moveable horizontal piston shaft 141 which is operable by a hydraulic cylinder 142. A plurality of compression springs 144*a*–144*d* may be inserted in aligned openings between adjacent blocks 139*a*–139*d* as shown in FIG. 10 to facilitate rapid and uniform linear spacing of said blocks when piston shaft 141 is operated to the right.

Reference is now had to FIG. 11 of the drawings which is a vertical sectional view taken along the line 11—11 of FIG. 10. The blocks 139*a* through 139*d* beneath the entrance table surface 136 rest upon and are slidable over the top surface of a plurality of horizontal supporting bars 145. The linearly extending horizontal bars 145 are supported upon a plurality of laterally extending members 146 secured to the top of a vertically moveable platen 147. Platen 147 is positioned and guided by a pair of vertical posts 148*a*–148*b* rigidly mounted to a floor base 149, while vertical motion is imparted to platen **147** by a hydraulic press cylinder **150** also secured to floor base **149.** When the blocks **139*a*–139*d*** are in their initial positions adjacent to each other, and the platen **147** is in its lowermost position as shown in FIG. **11,** all of the bottle retaining pins such as **138** are withdrawn beneath the surface **136** of the entrance station table, but the downstream gate pins such as **134*a*** remain protruding above the surface **136.** As shown in FIG. **11** the gate pin **134*a*** has its bottom end formed as a spring loaded cam follower **151** (as do all the other downstream gate pins **134*b*–134*e*** in FIG. **10**) which in this position rests upon a horizontal cam surface **152.** In the initial loading operation all the front gate stop pins such as **128** are lowered beneath the table surface **136** by downward operation of gate cylinder hydraulic operator **129,** so that bottles arriving on conveyor belt **126** are pushed thereby between linear guide bars **130** until further bottle motion is stopped by downstream gate pins **134*a*–134*e*.** When each column between bars **130** over the top of input table surface **136** has been filled with (four as shown in FIG. **11**) bottles, gate operator **129** raises front gate pins **128** to halt further movement of bottles on belt **126** onto the entrance table.

Referring now to FIG. **12** of the drawings, the next sequential operation following elevation of front gate pins **128** is elevation of platen **147** by upward operation of vertical press cylinder **150,** which causes the bottle retaining pins **138** to rise through slots **136** (FIG. **10**) above the table surface **136.** At this time the rear, or downstream, gate pins **134** also extend further above the surface **136** as shown in FIG. **12** but this condition will be changed upon the next sequential operation as illustrated in FIG. **13.**

Referring now to FIG. **13,** the next sequence is retraction of horizontal piston **141** by hydraulic cylinder operator **142** which effectively "stretches out" blocks **139*a*–139*d*** by sliding them from left to right along the surfaces of horizontal bars **145.** The blocks **139*a*–139*d*** are uniformly spaced in this operation by their interconnecting linkages (**140*a*, 140*b*** and **140*c*** FIG. **10**) and their movement into uniform linearly spaced relation is further facilitated by the interposed compression springs **144*a*–144*d*.** Also with this downstream movement (to the right in FIG. **13**) the rear gate pins such as **134*a*** are retracted to the same height as pins **138** by reason of their cam follower lower ends such as **151** sliding from left to right off of elevated cam surface **152** and down inclined cam surface **154** to the lowermost cam surface **155.** The next operation is lowering of platen **147** by downward operation of hydraulic piston **150,** which then withdraws all of the bottle retaining pins **138,** and rear gate pins **134,** beneath the surface **136** of the entrance station table. Following this operation a honeycomb carrier (FIG. **8**) as shown at **25** in FIG. **9** is lowered by the overhead piston mechanism **26** to surround the segregated and unfirmly spaced group of bottles at station A, and the reciprocating linear conveyor rods **30** are indexed to the left to engage the carrier **25** and then move it and its empty bottles to the first filling station B as illustrated in FIG. **9.** After the carrier has removed the group of bottles from station A to station B the piston **141** (FIG. **13**) is again operated to the left, and the apparatus is restored to the condition illustrated in FIG. **11,** except that now there are not bottles resting on blocks **139a-139d** as bottles on the conveyor belt **126** are still restrained by elevated front stop pins **128.** The final operation to reinitiate the cycle of sequential operations described hereinabove is actuation of vertical piston cyclinder **129** to lower the entrance gate pins **128** and admit another group of bottles to the entrance station.

Referring now to FIGS. **14–16** further details of construction of the apparatus of the invention are shown. FIG. **14** is a vertical end view, partially cut away, of the bottle separating and spacing input station as illustrated and described above with reference to FIG. **9** through FIG. **13.** In this illustrative embodiment the input table, of which only the right half was shown in plan view by FIG. **10,** is adapted to receive, segregate into groups and uniformly separate twelve linear rows of bottles **60,** each row being four bottles deep as shown and described above with reference to FIGS. **10**-FIG. **13,** thus accommodating, grouping and testing forty eight bottles (equivalent to two case loads) simultaneously, and continuously repeating the successive simultaneous operations as new bottles are fed into the apparatus from a continuous conveyor belt. As shown in FIG. **14** all of the input gate pins **128,** which serve in their elevated positions to temporarily restrain bottles on the conveyor belt until the input station is empty and ready to receive another batch, are mounted on and extend vertically upward from a horizontal bar **156** which is supported near its opposite ends on vertical piston shafts **157—157** of hydraulic piston operators **129—129.** The vertically moveable input station platen **147,** through which gate pins **128** pass freely, is supported at its opposite ends on the vertical piston shafts **153—153** of hydraulic press cylinders **150—150.** Piston cylinders **129** are firmly secured to the frames of cylinders **150** by mounting plates **158** whereby both cylinders **129** and **150** are rigidly mounted to the floor base **149.** The cam follower bottom ends **151** of rear gate pins **134** bear upon the top surface of cam **154** which extends through substantially the entire width of input station platen **147** as shown in FIG. **14.** The linearly slidable blocks **139** on which bottle retaining pins are mounted also extend the full width of platen **147** as shown in FIG. **14,** while a pair of horizontally disposed linearly operable block extending piston operators **142** are mounted on opposite sides of platen **147.** Four vertical guide posts **148** secured to floor base **149** slidably support platen **147** at opposite corners thereof as shown by FIG. **11** and FIG. **14,** to maintain platen **147** and the apparatus supported thereon constantly in parallel horizontal planes throughout its vertical operation by hydraulic cylinders **150.** As also shown in end view by FIG. **14** the input station table surface **136** is preferably formed of parallel elongated channel members **159** having depressed linear central portions **160** to reduce frictional engagement with the bottoms of bottles supported thereon. As also shown in FIG. **14** through FIG. **16** the linear separator bars **130** which extend between linear channel members **160,** leaving slots **135** therebetween through which vertically operable pins **128, 134** and **138** may rise, are preferably provided with removable plastic shoulder strips **161** which are adapted to slidably engage the side walls of bottles **60** whereby the bottles are guided in linear sliding motion with a minimum of friction.

As shown in FIG. **15** and FIG. **16,** guide strips such as **161** and **162** of differing widths may be installed on rails **130** to adapt the apparatus of the invention to accommodate different sizes of bottles, as may be desired. Of course, when bottle sizes are changed the carriers **25** must also be changed to provide differently sized honeycomb inserts (FIG. **8**). The hydraulic press mechanism which operates the test head platens at stations D and E (FIG. **1**) may be adjusted to operate at different vertical positions in order to accommodate bottles of any given height. The sequence of operation of the several piston operators as described hereinabove may be controlled by any suitable timing mechanism, either electrical or mechanical, whereby the apparatus of the invention may be operated continuously and automatically to successively test large groups of glass containers for structural integrity.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above method and in the constructions set forth without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Means for testing closed containers comprising in combination,

A. first means for simultaneously applying a preselected axial load and preselected internal test pressure to a plurality of containers, and

B. second selective holding means separate from said first means for retaining containers which withstand said axial load and internal test pressure and for simultaneously releasing all containers which fail to withstand either said axial load or said internal test pressure.

2. The combination of claim **1** wherein said holding means comprises in combination,

A. a cyclically operable and closable bottom support beneath said separate holding means,

B. a selectively releasable top support for each container under test, and

C. sensing means responsive to the presence of internal pressure within a container to maintain said top support in closed container holding condition while releasing said top support when no internal pressure is sensed.

3. The combination of claim **1** wherein said pressure applying means includes means for simultaneously filling all of said containers with fluid, and said holding means comprises in combination,

A. a selectively operable top engaging chuck for each tested container having,

1. means for sensing the displacement of fluid within a container, and

2. means responsive to the sensing of fluid displacement to open said chuck and release a container in which fluid displacement is sensed.

4. In an automatic testing machine for determining structural integrity of closed containers as defined by claim **1**, the combination comprising,

A. a plurality of container engaging chucks,

B. fluid sensing means within said chucks whereby individual chucks are selectively operated in a first mode to release containers in which fluid displacement is sensed, and

C. further means within said chucks operable in a second mode to release all of said container engaging chucks simultaneously, whereby sound containers are disengaged from the testing machine.

5. In an automatic testing machine for simultaneously determining the structural integrity of preselected groups of containers, the combination comprising,

A. a plurality of portable honeycomb carriers each adapted to contain a group of containers,

1. centering means in each of said carriers for uniformly positioning the group of containers therein,

B. means for positioning each said carrier individually and successively on a preselected group of containers at an entrance station of said testing machine,

C. reciprocating conveyor means engageable with said carriers so positioned for transporting said carriers and containers to successive stations of said testing machine, and

D. recirculating conveyor means for removing each said carrier from its group of containers upon completion of testing and for returning each said carrier so removed to said entrance station.

6. Means for simultaneously testing a plurality of containers for structural integrity which comprises in combination,

A. means for filling all of said containers substantially simultaneously with a fluid,

B. means for applying a preselected fluid test pressure simultaneously to all of said filled containers for a predetermined time, and

C. releasable holding means responsive to fluid displacement sensing means for selectively engaging those containers which withstand said preselected fluid test pressure and for releasing those containers which have failed structurally following application of said preselected test pressure.

7. The method of simultaneously testing a plurality of containers for hidden structural weakness which comprises the steps of:

A. first filling said plurality of containers substantially simultaneously with a fluid,

B. then subjecting said plurality of filled containers to a preselected fluid test pressure applied simultaneously to all of said containers for a predetermined time,

C. thereafter testing all of said previously pressurized containers for fluid integrity by sensing fluid displacement, and discarding those containers in which fluid displacement is detected while retaining only those containers that have withstood said test pressure and in which no substantial fluid displacement is sensed.

8. A pressure testing machine for closed containers comprising in combination,

A. means for simultaneously moving a preselected plurality of empty containers under a corresponding plurality of liquid filling spouts, whereby all of said containers are completely filled with liquid substantially simultaneously,

B. means for connecting a corresponding plurality of hydraulic pressure lines substantially simultaneously to said plurality of containers, and for applying a preselected hydraulic pressure to each of said containers simultaneously for a predetermined time,

C. means for subsequently applying a corresponding plurality of fluid displacement sensors to said plurality of containers,

1. said fluid displacement sensors including releasable means for engaging and holding each container in which no substantial fluid displacement is sensed and for releasing containers in which fluid displacement is sensed.

9. A pressure testing machine for containers comprising in combination,

A. means for simultaneously moving a preselected plurality of empty containers under a corresponding plurality of liquid filling spouts, whereby all of said containers are completely filled with liquid substantialy simultaneously,

B. means for connecting a corresponding plurality of hydraulic pressure lines substantially simultaneously to said plurality of containers, and for applying a preselected hydraulic pressure to all of said containers simultaneously for a predetermined time,

C. means for subsequently applying a corresponding plurality of liquid displacement sensors to said plurality of containers,

1. said displacement sensors including releasable means for engaging and holding each container in which no substantial displacement is sensed and for releasing containers in which displacement is sensed,

D. means for disposing by gravity those containers not engaged and held by said displacement sensing means, and

E. means for subsequently releasing those containers engaged by said releasable means and for moving said subsequently released containers onto an exit conveyor.

10. A pressure testing machine for containers according to claim **8** wherein:

A. said container moving means comprises a topless and bottomless honeycomb carrier adapted to engagingly fit over and substantially surround a plurality of containers rested on a plane table surface, and

1. a pair of parallel horizontally reciprocating conveyor rods releasably engageable with opposite sides of said carrier to slide said carrier and containers therein to successive positions on said plane table surface.

11. A pressure testing machine for containers according to claim **8** wherein said means for connecting a plurality of hydraulic pressure lines to said containers comprises a vertically reciprocable press platen having mounted thereon,

A. a plurality of individual hydraulic pressure heads corresponding to said plurality of containers, each said pressure head:

1. connected with a source of hydraulic fluid under pressure,

2. slidably supported on and spring biased downwardly from said platen,

3. having a valve member normally closed by said downward spring bias, and

4. a resiliently compressible annular sealing member affixed to the bottom end thereof surrounding said valve member and adapted to sealingly engage the open mouth of a container placed thereunder, whereby upon downward movement of said reciprocable platen each test head sealingly engages the open top of a container thereunder and continued downward motion of said platen opens said valve member to apply hydraulic pressure internally to said container.

12. A pressure testing machine for containers according to claim **8** wherein said means for subsequently applying a corresponding plurality of fluid displacement sensors to said plurality of containers comprises in combination,

A. a horizontally disposed vertically moveable press platen mounted on said machine for reciprocable motion above a plane test table on which containers are positioned for testing,

1. means for moving said platen upwardly and downwardly in planes parallel to said test table,

B. a plurality of vertically disposed press heads corresponding to said plurality of containers mounted on said platen and moveable therewith, each said press head having,

1. a plurality of chuck operated finger hooks for gripping the neck of a container placed thereunder,

2. means for effecting pressure sealing engagement with the mouth of a container thereunder,

3. a vertically moveable plunger passed through said sealing means and adapted to enter the mouth of a container thereunder whereby the presence or absence of fluid therein may be detected,

a. pressure means connected to said plunger for applying downward force thereto,

b. reversible pressure means for raising said plunger, and

4. means including a chuck connecting said plunger with said finger hooks whereby said hooks are released upon substantial downward movement of said plunger within a container.

13. A pressure testing machine for containers according to claim **8** wherein said means for subsequently applying a corresponding plurality of displacement sensors to said plurality of containers comprises in combination,

A. a first horizontally disposed press platen mounted on said machine for vertical motion above a test table onto which said containers are placed,

1. a first double acting piston operator mounted on said machine and connected to said first platen for imparting vertical motion thereto either upwardly or downwardly,

B. a second horizontal press platen mounted on and vertically moveable with respect to said first platen,

1. a second double acting piston operator mounted on said first platen and connected to said second platen for imparting vertical motion thereto either upwardly or downwardly with respect to said first platen,

C. a plurality of vertical press heads corresponding to said plurality of containers, each said press head connected to each of said press platens and including:

1. a first hollow cylindrical member having an upper end attached to and a lower end depending from said first press platen, the lower end of said

cylindrical member extending through a concentric opening in said second platen,

2. an inner hollow cylindrical member concentric with said first cylindrical member and slidably mounted in the lower end thereof with a bottom end of said inner member protruding from the lower end of said first cylindrical member,

a. a resiliently compressible annular sealing gasket affixed to the bottom end of said inner hollow cylindrical member and adapted to sealingly engage the open mouth of a container placed thereunder,

b. an annular shoulder formed on the upper end of said inner cylindrical member engageable with an inner annular shoulder formed in the bore of said first hollow cylindrical member to limit downward sliding motion of said inner cylindrical member,

c. first spring means within the bore of said first cylindrical member between the upper end of said inner cylindrical member and said first platen for imparting downward pressure on said inner cylindrical member,

3. a plurality of downwardly extending finger hooks pivotally mounted on and depending from the outer lower end of said first cylindrical member,

a. second spring means biasing said depending finger hooks outwardly from the axis of said first cylindrical member,

4. an outer cylindrical chuck sleeve slidably mounted upon said first cylindrical member and substantially enclosing and restraining said finger hooks against the bias of said second spring means,

a. third spring means between said first cylindrical member and said outer chuck sleeve normally holding said sleeve in a raised position whereby said finger hooks are closed against the force of said second spring means and engaged with the neck of a container placed thereunder,

5. a vertically moveable plunger slidably supported within said inner hollow cylindrical member with its lower end extending through said annular sealing gasket in a position to enter the mouth of a container placed thereunder,

a. an upper portion of said plunger passing through both of said press platens and connected to a double acting piston within a sealed pressure cylinder mounted upon said first platen,

6. a vertically moveable push rod freely slidable through aligned openings in both said platens,

a. the lower end of said push rod engageable with the upper end of said chuck sleeve and operable to depress said sleeve against the force of said third spring means whereby said finger hooks may be opened to disengage the neck of a container placed thereunder,

b. means connected to the upper end of said push rod engageable with means on the upper end of said plunger to depress said push rod into operative engagement with said chuck sleeve when said plunger decends into a pressureless container, and

D. further means on said second platen engageable with each of said plurality of press head chuck sleeves whereby all of said chucks are depressed to open all of said finger hooks when said second platen is moved downwardly in response to said second double acting piston operator.

14. In automatic container handling machines, apparatus for selecting, segregating and uniformly centering preselected groups of containers as randomly delivered on a continuously moving conveyor, comprising:

A. an input table surface adjacent to, contiguous with and in the same plane as the end of a continuous horizontal belt conveyor,

1. said surface formed of a plurality of uniform linearly extending segmented parallel block members having parallel slots therebetween extending linearly in the direction of said conveyor belt motion,

B. a plurality of uniformly spaced parallel horizontal spacer bars extending linearly in the direction of said conveyor belt motion, mounted above and parallel to said input table surface, and extending linearly between and parallel to said slots,

C. a plurality of linearly moveable laterally extending parallel block members slidably mounted beneath said table surface on a vertically moveable horizontally disposed platen,

1. linking means interconnecting each of said moveable block members with its adjacent moveable block members,

2. a linearly moveable first piston connected to the last one of said moveable block members whereby all of said block members may be moved linearly in the direction of said conveyor belt motion,

a. a plurality of spring loaded vertically moveable pins mounted in the last of said moveable block members and normally extending through said parallel slots in said table surface to provide stops for containers accumulated in each row of containers received from said conveyor belt,

b. an inclined cam surface on said vertically moveable platen engageable with the bottom end of said spring loaded pins whereby said pins are moved downwardly below the surface of said table when said blocks are moved linearly by said piston, and

D. second piston means for reciprocably moving said block supporting platen upwardly to cause said vertically extending pins to engage a selected group of containers, and downwardly to disengage said group of containers from said pins after said group has been uniformly separated in the linear direction by operation of said first piston.

15. The combination of claim **14** including,

A. a plurality of honeycomb carriers each open at top and bottom and adapted to surround a predetermined group of containers,

1. partition means in each of said carriers for uniformly spacing the containers therein,

B. means for positioning each of said carriers individually and successively over and around a preselected group of containers on said input table surface,

C. reciprocating linear conveyor means engageable with each said carrier so positioned for transporting said carriers and containers to successive stations of a container testing machine, and

D. recirculating conveyor means for removing each said carrier from its group of containers upon completion of testing and for returning each said carrier successively to said carrier positioning means at said input table.

16. The method of automatically selecting, segregating and uniformly separating groups of containers as randomly received in bulk which comprises the steps of:

A. first depositing containers at random onto a continuously moving conveyor,

B. separating containers on said conveyor into parallel rows by causing them to pass between parallel linear guides onto a receiving table,

C. stopping the receipt of containers in each row at an exit edge of said table,

D. accumulating a full column of contiguously adjacent containers in each row between said linear guides,

E. stopping the receipt of containers at the entrance edge of said table upon the filling of all columns of said parallel rows, and

F. effectively stretching said receiving table linearly in the direction of said parallel guides to achieve uniform linear spacing of said containers in each row.

17. Means for automatically selecting, segregating and uniformly separating groups of containers as randomly received in bulk comprising in combination,

A. means for depositing containers at random onto a continuously moving unidirectional linear conveyor,

B. a stationary receiving table in substantially the same plane as the surface of said conveyor and having one edge adjacent to the downstream end of said continuously moving conveyor,

C. a plurality of uniformly spaced parallel horizontal spacer bars mounted on said table and extending linearly in the direction of said conveyor movement over the downstream end of said conveyor, to align containers received therebetween into parallel laterally spaced linear columns,

D. first moveable stop means along the edge of said table opposite said one edge adjacent said conveyor, to form a barrier limiting further movement of containers received thereon,

E. second moveable stop means along the edge of said table adjacent said conveyor and operable upon receipt of a predetermined number of containers on said table between said spacer bars to inhibit movement of further containers, and

F. moveable means for effectively expanding said table linearly between said first and second stop means to achieve uniform equidistant linear separation between containers in each parallel linear column.

18. The combination of claim **17** wherein said moveable means for effectively expanding said table linearly comprises,

A. a plurality of parallel slots extending linearly through said table,

B. a plurality of moveable members beneath said table and extending laterally parallel to said table surface in a direction substantially normal to said slots,

1. means linking adjacent members to each other to permit limited linear motion therebetween in a direction parallel to said slots,
2. container engaging means mounted on said members and extendable upwardly through said slots,
3. first moving means for simultaneously moving all of said members upwardly toward the bottom of said table, whereby said engaging means extend through said slots above the top surface of said table to engage containers thereon,
4. second moving means for imparting linear motion to at least one of said members whereby all of said members are moved through said linking means expansively in a direction parallel to said slots, and
5. further means including said first and second moving means operable subsequently to lower said members and said engaging means below the surface of said table and to restore said moveable members compressibly to their original condition in side by side relation.

19. In an automatic system for testing closed containers for structural integrity the combination comprising,

A. means for receiving a plurality of containers at an input station,

B. means at said input station for selecting and grouping a predetermined number of received containers into a uniformly centered configuration wherein adjacent containers of a selected group are equally spaced from each other,

C. means for moving successive groups of said selected and centered containers to a fluid filling station where all containers of each group are simultaneously filled with fluid,

D. means for applying a predetermined hydrostatic fluid pressure to all containers in a group simultaneously,

E. means including selectively operable individual container holding means for sensing fluid displacement within each container of a group subsequent to application of said predetermined hydrostatic fluid pressure,

1. said holding means operable in response to the sensing of fluid displacement in any container to release said container, and to retain all containers in which no fluid displacement is sensed, and
2. further means operable subsequently to simultaneously release all of said individual holding means.

20. The apparatus and method for automatically testing closed containers for structural integrity substantially as illustrated and described herein.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,771,649 Dated November 13, 1973

Inventor(s) Leopold Strauss

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the title page insert --Assignee: Automated Machine Systems Inc.--. In the abstract, fourth line from bottom, change "chunks" to --chucks--. Column 3, line 64, after "which" and before "the" delete --all--. Column 4, line 7, change "sidwall" to --sidewall--. Column 6, line 57, change "clsoed" to --closed--. Column 10, line 5, change "mvoing" to --moving--; line 11, change "donwwardly" to --downwardly--; line 31, change "donw-stream" to --downstream--. Column 11, line 58, change "unfirmly" to --uniformly--; line 67, change "not" to --no--; Column 15, line 17, change "substantialy" to --substantially--.

Signed and sealed this 14th day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents