United States Patent

Johnson et al.

[15] **3,702,524**

[45] **Nov. 14, 1972**

[54] **CASE LOADER WITH ARTICLE INVERTING MECHANISM**

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[73] Assignee: **Emhart Corporation,** Bloomfield, Conn.

[22] Filed: **Dec. 14, 1970**

[21] Appl. No.: **97,534**

Related U.S. Application Data

[63] Continuation of Ser. No. 13,638, Feb. 24, 1970, abandoned.

[52] **U.S. Cl.** **53/61,** 53/74, 53/248

[51] **Int. Cl.** **B65b 57/10**

[58] **Field of Search**.....53/61, 74, 248, 392

[56] **References Cited**

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Primary Examiner—Travis S. McGehee

Attorney—McCormick, Paulding & Huber

[57] **ABSTRACT**

An infeed conveyor is provided for advancing upright articles in a plurality of lanes across a deadplate and into a lane defining grid as a result of line pressure from the articles advancing on the conveyor. Means is provided above each such lane for braking or holding back the articles on the deadplate so that discrete charges, or slugs of articles, can be formed in the grid. The grid is adapted to be retracted slightly, away from the deadplate, and to be rotated to an inverted position. Hinged doors on the grid are moved into contact with the upper end portions of the upright articles to hold them in the grid as it is so rotated. An empty packing case to be loaded is raised upwardly to receive the inverted articles in the grid, and the doors are then moved to their open positions causing the articles to drop downwardly onto the upwardly open packing case. Two embodiments of the invention are shown, one having a single grid, and the second having a double grid.

16 Claims, 16 Drawing Figures

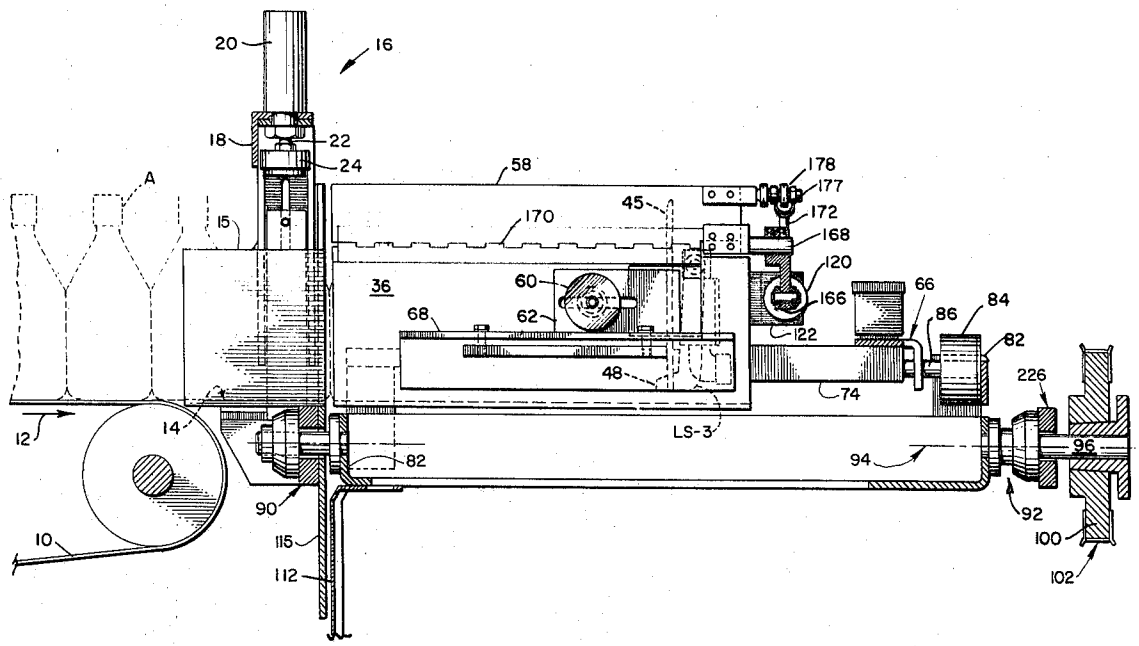


FIG. 1

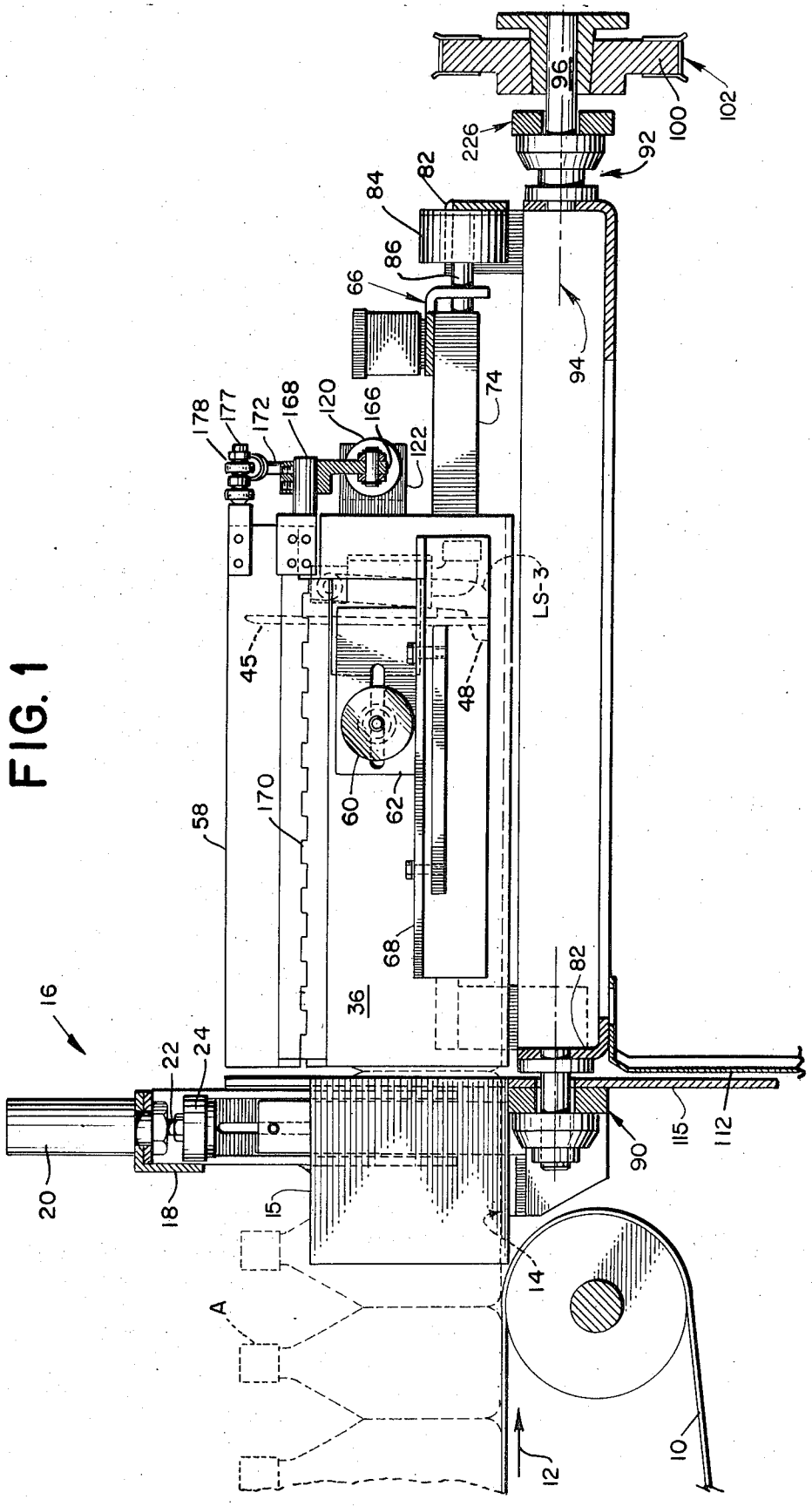
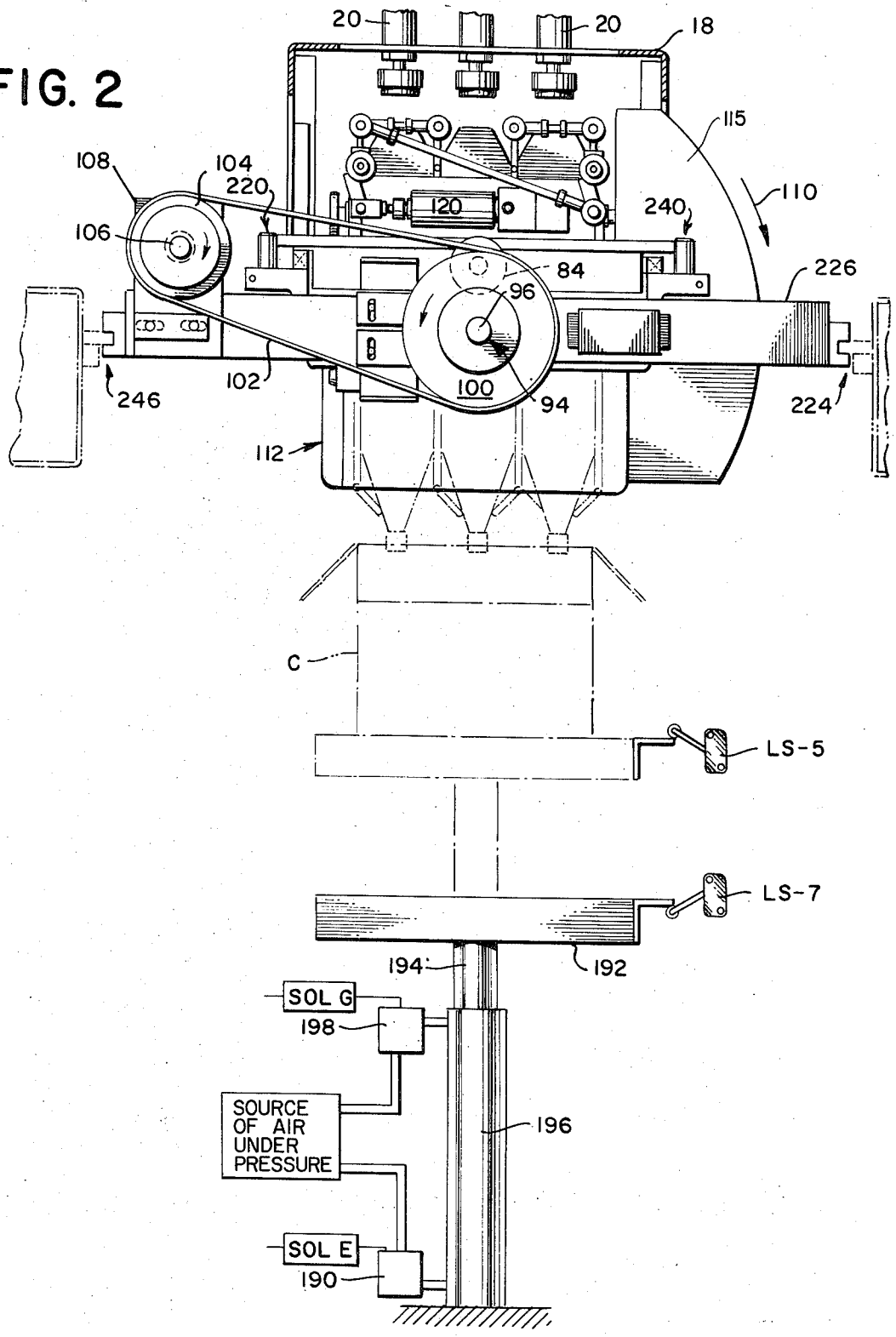

96
102
100
226
92
84
82
86
66
94
74
178
177
172
168
120
166
122
LS-3
45
48
60
62
58
170
68
36
82
16
22
24
20
18
15
14
115
112
90
A
12
10

FIG. 2


20
20
18
115
110
108
104
220
106
120
240
84
96
226
246
102
100
94
224
112
C
LS-5
LS-7
194
192
SOL G
198
SOURCE OF AIR UNDER PRESSURE
196
SOL E
190

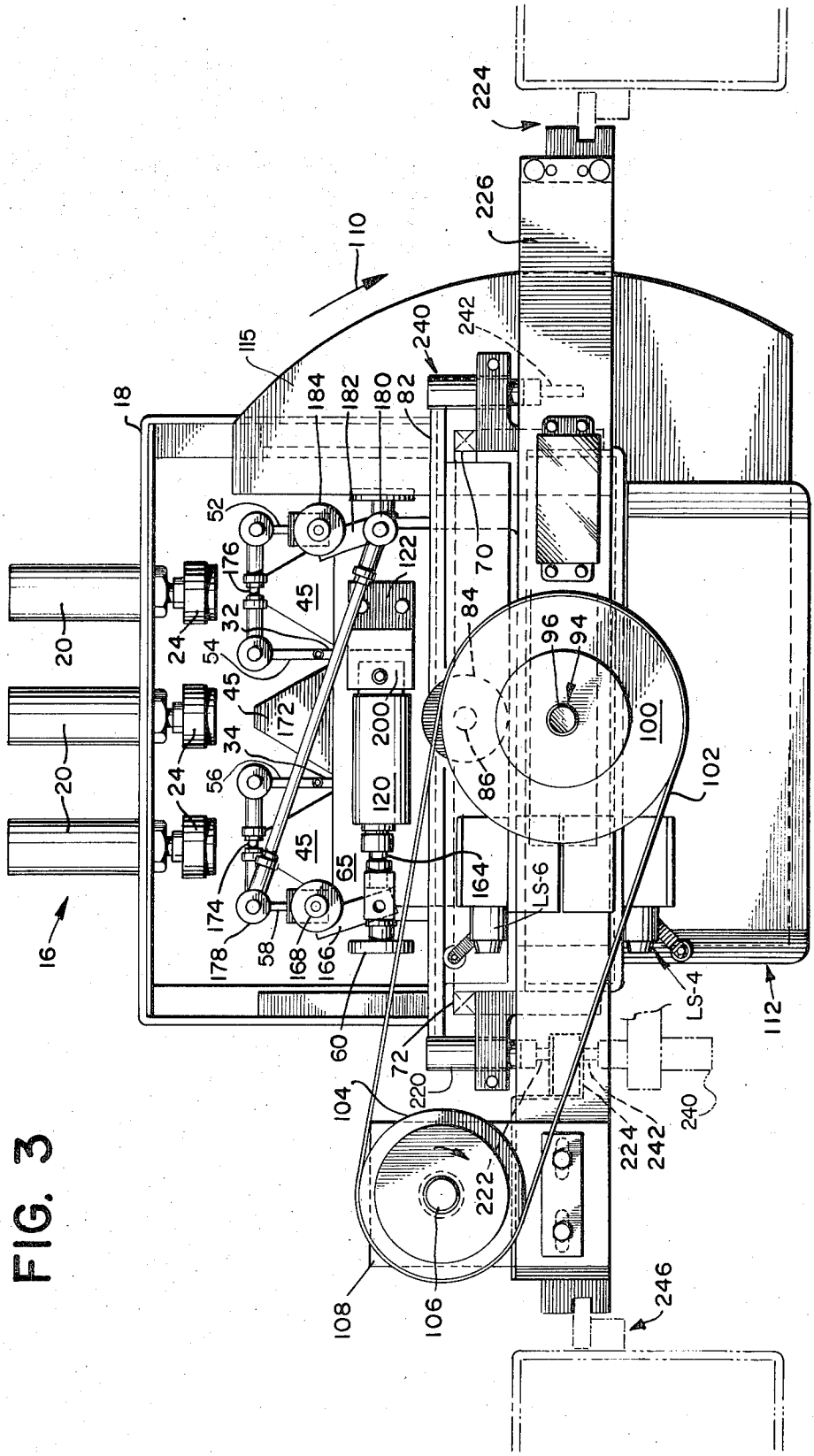

224
226
110
240
242
115
18
184
182
180
82
52
122
70
176
45
32
84
24
54
96
94
20
45
34
172
200
100
24
56
120
86
102
20
24
45
65
164
LS-6
174
178
58
168
166
16
60
72
LS-4
112
104
220
240
224
242
222
108
106
246

FIG. 3

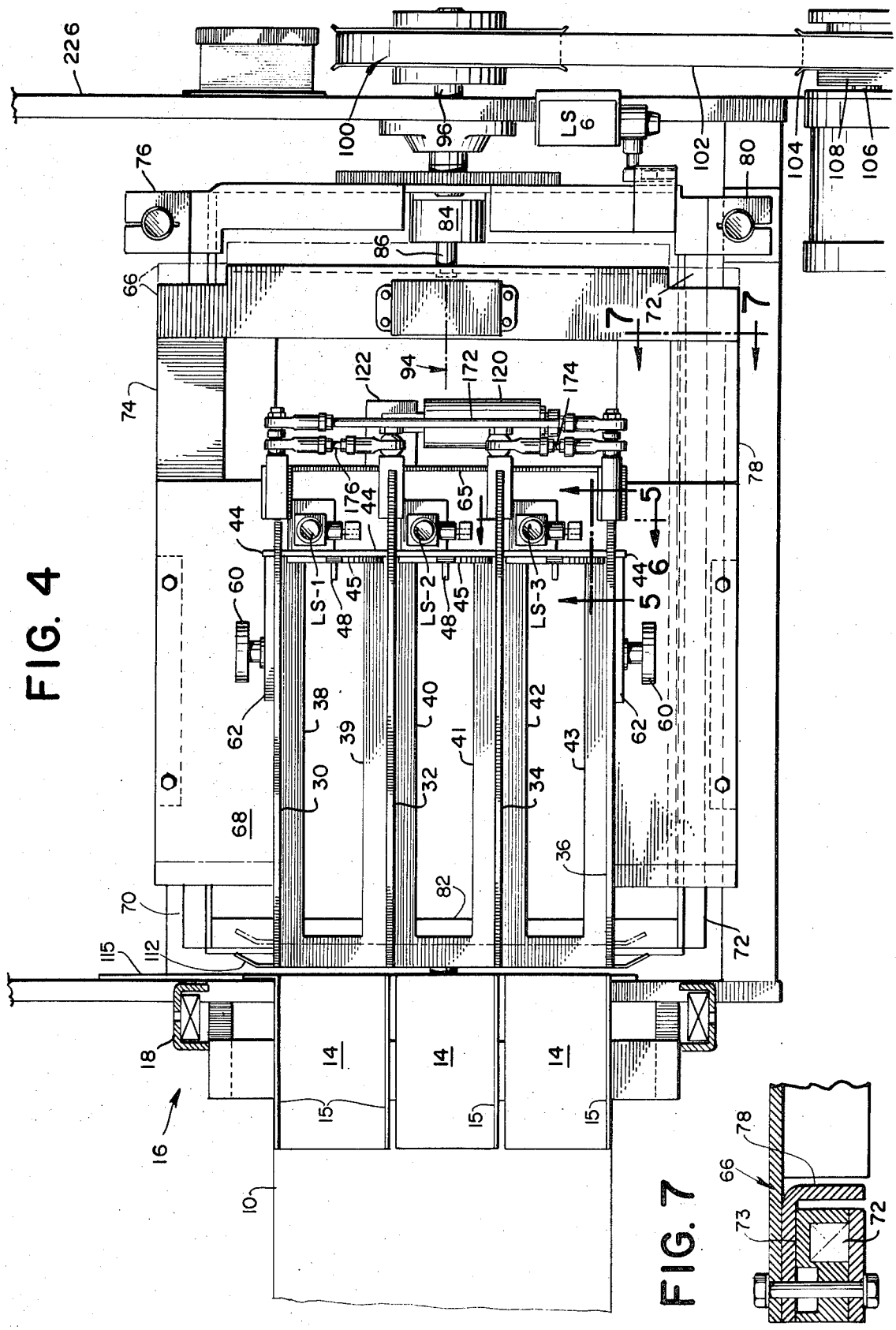

226
100
96
LS 6
102
80
104
108
106
76
84
86
66
72
7
7
74
122
94
172
120
174
78
176
44
65
5
5
44
LS-1
LS-2
LS-3
45
48
60
62
38
39
40
41
42
43
30
32
34
36
68
82
70
115
112
72
18
14
14
14
15
15
15
16
10

FIG. 4

78
66
73
72

FIG. 7

FIG. 5

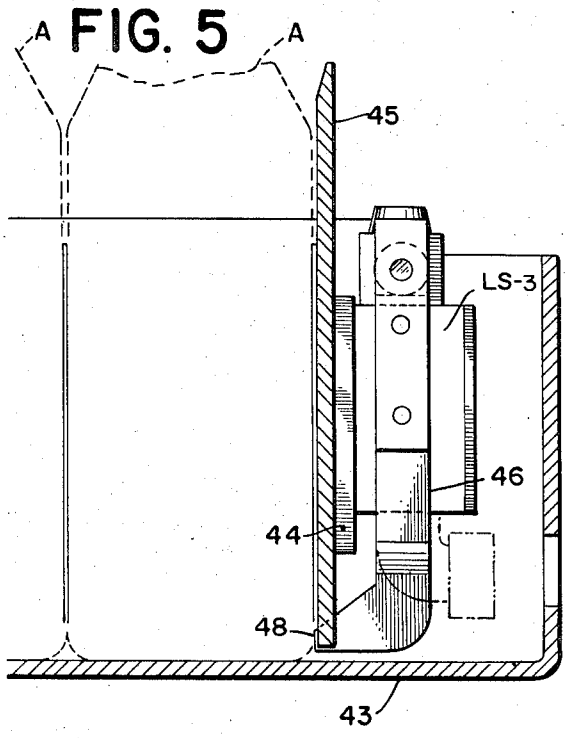
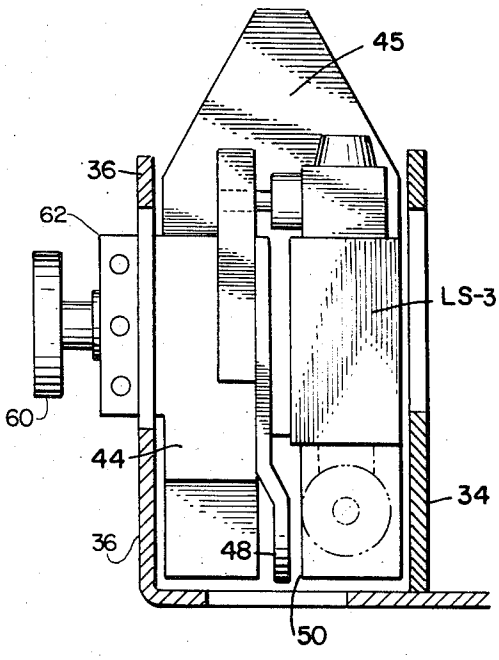


FIG. 6



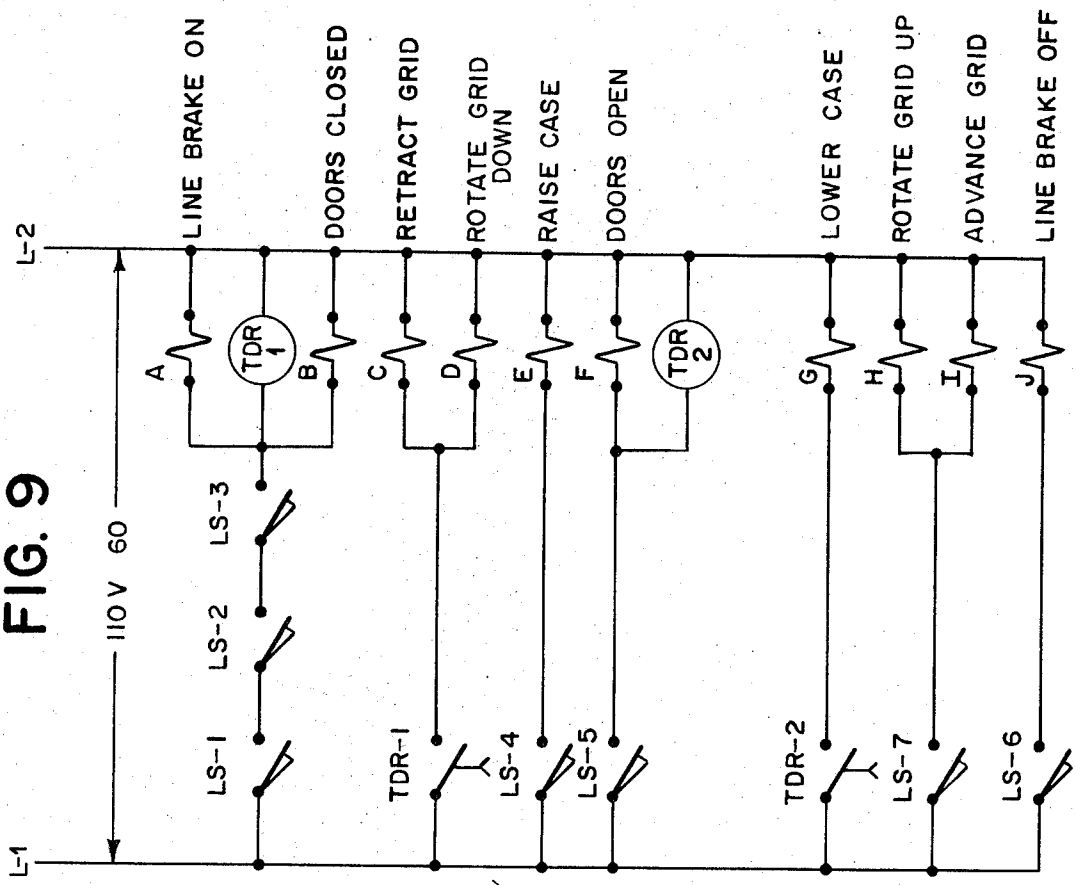

L-2
L-1
110 V 60
LINE BRAKE ON
DOORS CLOSED
RETRACT GRID
ROTATE GRID DOWN
RAISE CASE
DOORS OPEN
LOWER CASE
ROTATE GRID UP
ADVANCE GRID
LINE BRAKE OFF
A
TDR 1
B
C
D
E
F
TDR 2
G
H
I
J
LS-1
LS-2
LS-3
TDR-1
LS-4
LS-5
TDR-2
LS-7
LS-6

FIG. 9

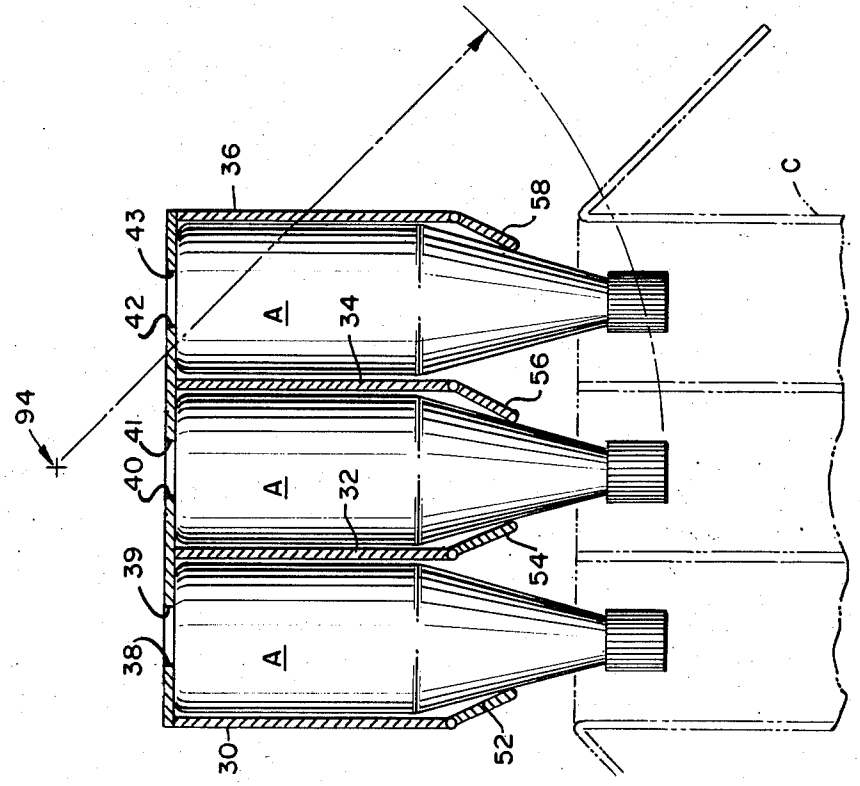

36
43
42
41
40
39
38
30
94
A
34
32
58
56
54
52
C

FIG. 8

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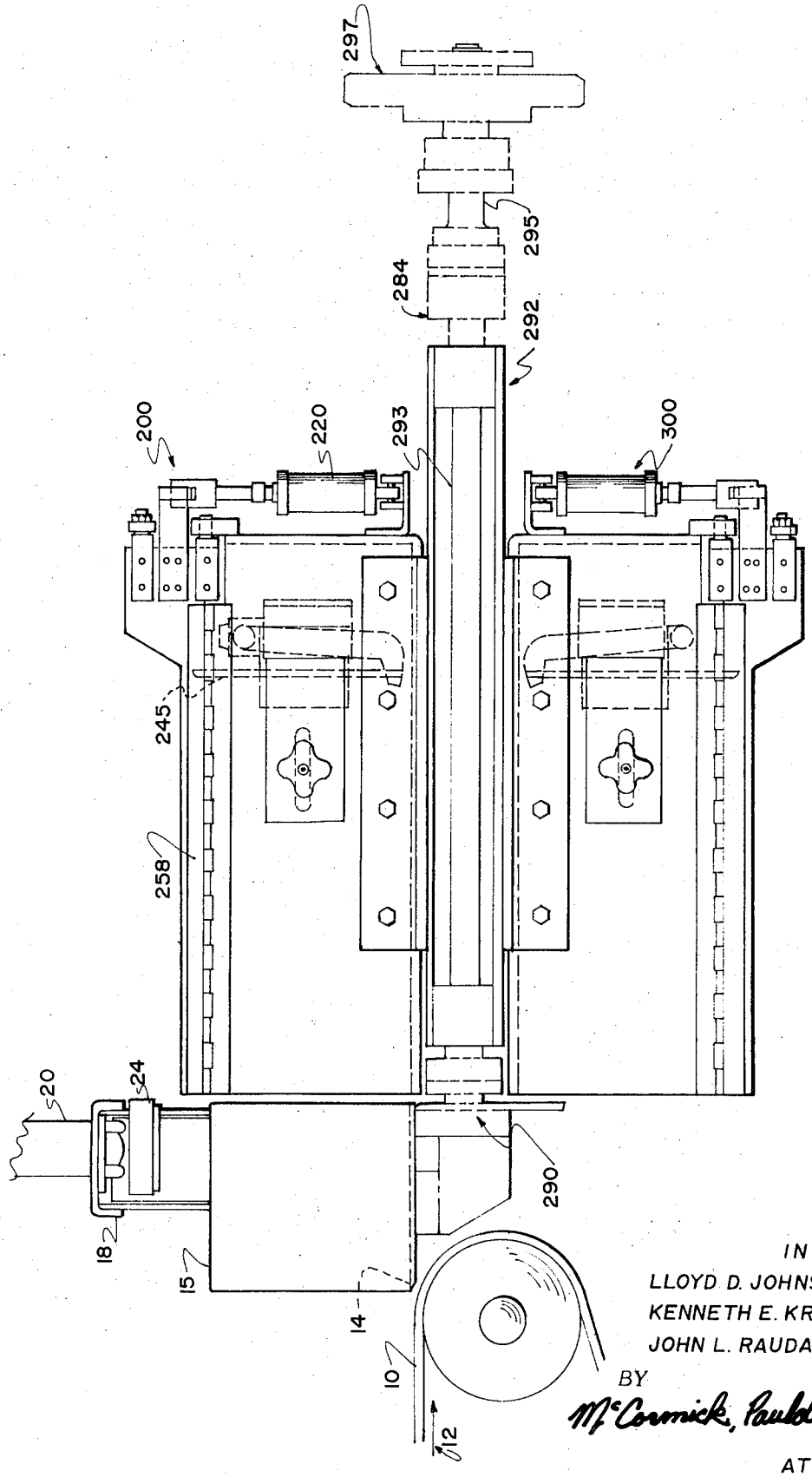


FIG. 10

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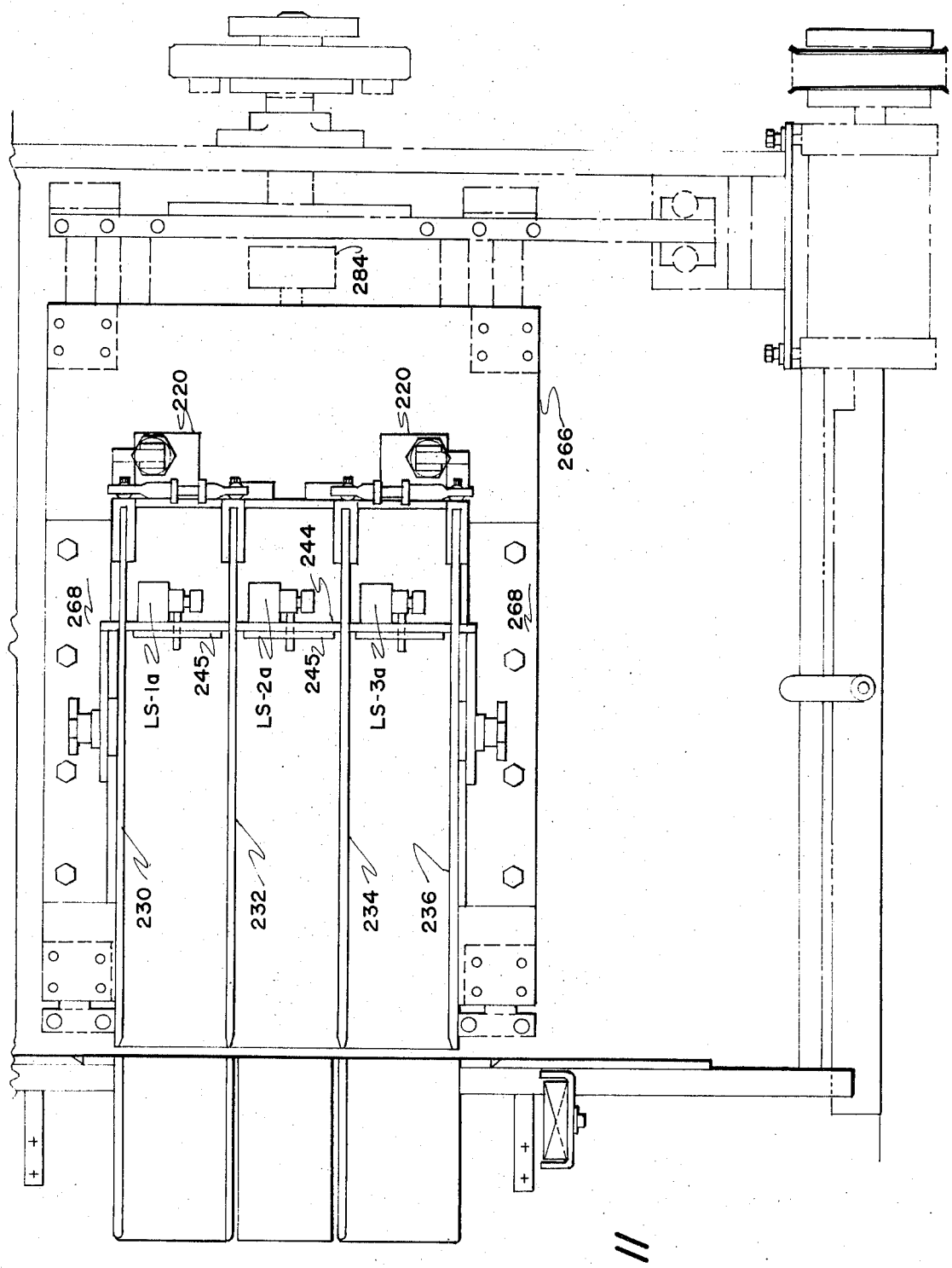

284
220
220
266
244
268
268
LS-1a
245
LS-2a
245
LS-3a
230
232
234
236

FIG. 11

FIG. 13

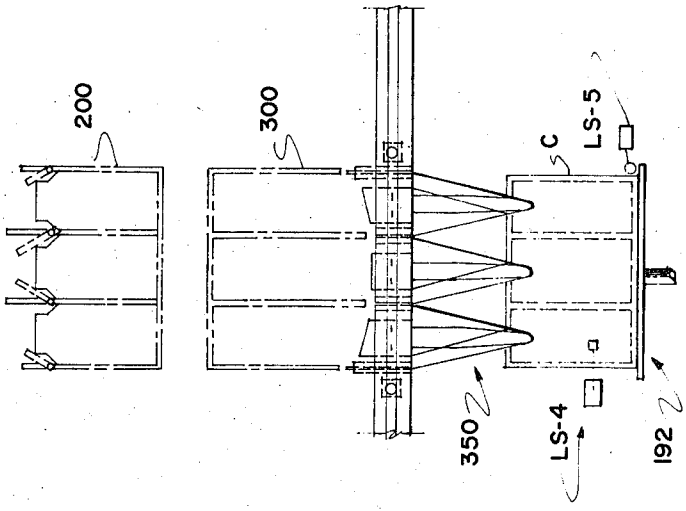
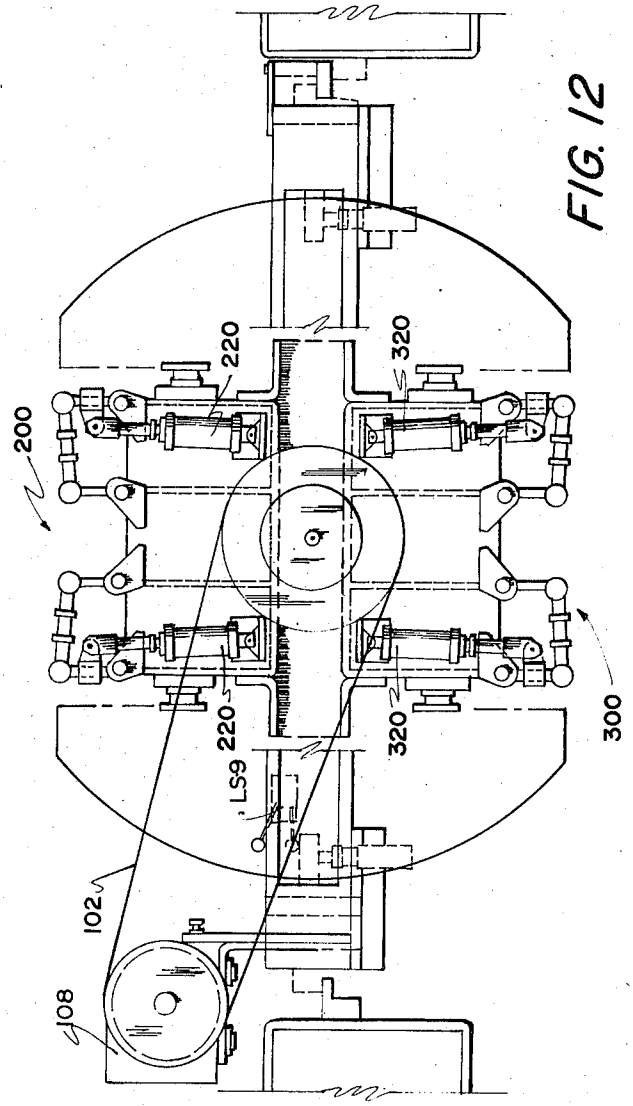


FIG. 12



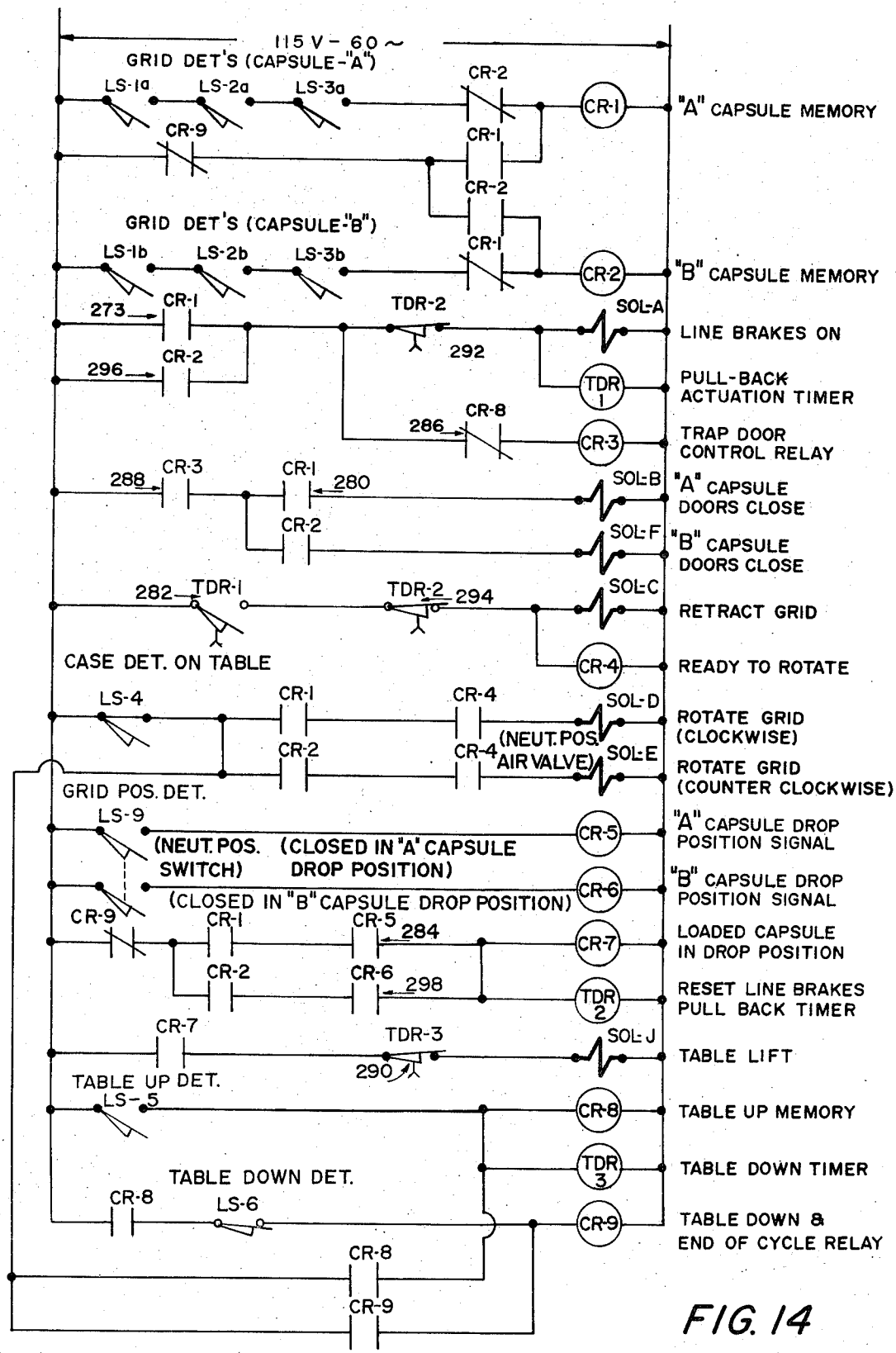

115 V - 60 ~
GRID DET'S (CAPSULE-"A")
LS-1a
LS-2a
LS-3a
CR-2
CR-1
"A" CAPSULE MEMORY
CR-9
CR-1
CR-2
GRID DET'S (CAPSULE-"B")
LS-1b
LS-2b
LS-3b
CR-1
CR-2
"B" CAPSULE MEMORY
273
CR-1
TDR-2
SOL-A
LINE BRAKES ON
292
296
CR-2
TDR 1
PULL-BACK ACTUATION TIMER
CR-8
286
CR-3
TRAP DOOR CONTROL RELAY
288
CR-3
CR-1
280
SOL-B
"A" CAPSULE DOORS CLOSE
CR-2
SOL-F
"B" CAPSULE DOORS CLOSE
282
TDR-1
TDR-2
294
SOL-C
RETRACT GRID
CASE DET. ON TABLE
CR-4
READY TO ROTATE
LS-4
CR-1
CR-4
SOL-D
ROTATE GRID (CLOCKWISE)
CR-2
CR-4
(NEUT. POS. AIR VALVE)
SOL-E
ROTATE GRID (COUNTER CLOCKWISE)
GRID POS. DET.
LS-9
CR-5
"A" CAPSULE DROP POSITION SIGNAL
(NEUT. POS. SWITCH)
(CLOSED IN "A" CAPSULE DROP POSITION)
CR-6
"B" CAPSULE DROP POSITION SIGNAL
(CLOSED IN "B" CAPSULE DROP POSITION)
CR-9
CR-1
CR-5
284
CR-7
LOADED CAPSULE IN DROP POSITION
CR-2
CR-6
298
TDR 2
RESET LINE BRAKES PULL BACK TIMER
CR-7
TDR-3
SOL-J
TABLE LIFT
290
TABLE UP DET.
LS-5
CR-8
TABLE UP MEMORY
TDR 3
TABLE DOWN TIMER
TABLE DOWN DET.
CR-8
LS-6
CR-9
TABLE DOWN & END OF CYCLE RELAY
CR-8
CR-9

FIG. 14

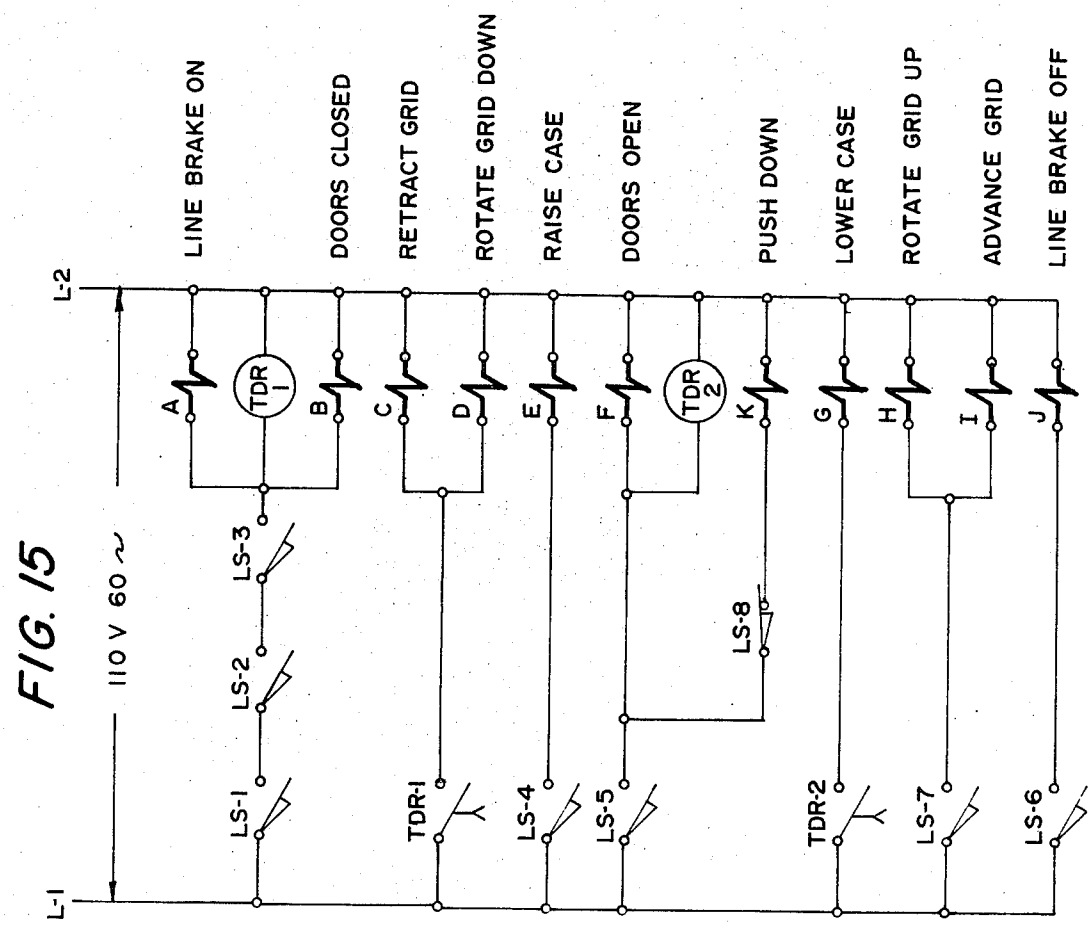

LINE BRAKE ON
DOORS CLOSED
RETRACT GRID
ROTATE GRID DOWN
RAISE CASE
DOORS OPEN
PUSH DOWN
LOWER CASE
ROTATE GRID UP
ADVANCE GRID
LINE BRAKE OFF
L-2
L-1
110 V 60 ~
A
TDR 1
B
C
D
E
F
TDR 2
K
G
H
I
J
LS-3
LS-2
LS-1
LS-8
TDR-1
LS-4
LS-5
TDR-2
LS-7
LS-6

FIG. 15

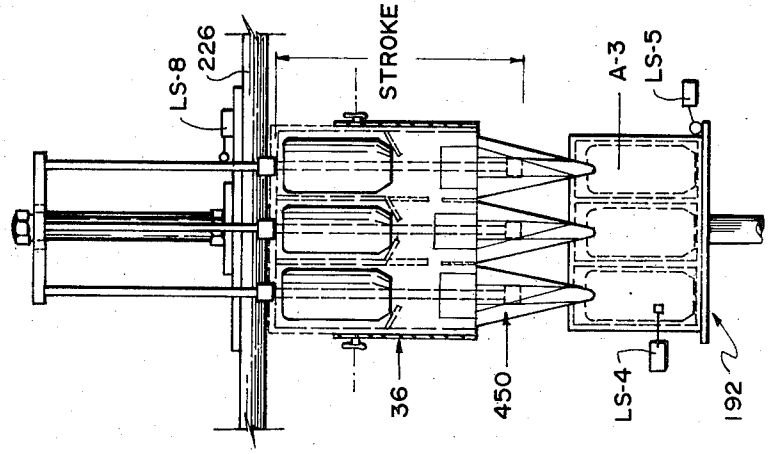

LS-8
226
STROKE
A-3
LS-5
36
450
LS-4
192

FIG. 16

CASE LOADER WITH ARTICLE INVERTING MECHANISM

SUMMARY OF INVENTION

This application is a continuation of our earlier application of the same title filed Feb. 24, 1970, under Ser. No. 13,638, now abandoned.

This invention relates to packing case loading devices, and deals more particularly with a case loader which is adapted to receive successive charges, or slugs, or upright articles, from a continuously operated infeed conveyor, and which case loader inverts these charges of articles so that they can be deposited in an upwardly open packing case. At least one multi-lane defining grid is rotatably mounted at the downstream end of the infeed conveyor, and when its lanes are filled with articles so as to form a charge the grid is rotated to invert the articles in the grid. The grid is open at the top, and doors are provided thereon for holding the articles in the grid when said grid is rotated to its inverted position. The doors then control the release of the articles for free fall into the upwardly open packing case. Two such grids are mounted on a single frame in the preferred embodiment.

An object of the present invention is to provide a case loader which receives upright articles from an infeed conveyor, and which forms a charge of these articles and inverts them for loading into an upwardly open packing case.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of a case loader embodying the present invention, with the multi-lane defining grid portion thereof shown in its article receiving position.

FIG. 2 is an end view showing the apparatus of FIG. 1 with the multi-lane defining grid portion shown in its discharge position in phanthom lines, and also shows a case to be loaded with its associated lift table in its raised and in its lowered position in phanthom and in solid lines respectively.

FIG. 3 is an end view of the lane defining grid portion shown to a somewhat larger scale.

FIG. 4 is a plan view of the lane defining grid portion of the apparatus shown in FIGS. 1, 2 and 3.

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 4.

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 4.

FIG. 7 is a sectional view on line 7—7 of FIG. 4.

FIG. 8 is a schematic view of the inverted position for the articles in the lane defining grid means, showing the doors in their closed position and the packing case to be filled in its elevated position.

FIG. 9 is an electrical schematic diagram showing the sequence of operation for the apparatus shown in FIGS. 1 through 8.

FIG. 10 is a view similar to FIG. 1, but showing a modified form of the present invention.

FIG. 11 is a plan view of the FIG. 10 apparatus.

FIG. 12 is an end view of the FIG. 10 apparatus.

FIG. 13 is a schematic end view of the FIG. 10 apparatus, and also shows a fixed funnel for use in handling articles other than those with narrow necks of the type shown in FIG. 1.

FIG. 14 is an electrical schematic diagram showing the control circuitry for the apparatus of FIGS. 10–13.

FIG. 15 is an electrical schematic diagram showing circuitry similar to that of FIG. 9, but with components for operating push downs in an apparatus of the type shown in FIGS. 1–8.

FIG. 16 is a schematic view of an apparatus such as shown in FIGS. 1–8, with push downs added to accommodate "wide mouth" articles.

DETAILED DESCRIPTION

Turning now to the drawings in greater detail, FIG. 1 shows a line of articles A,A which are being fed toward the right in the direction of the arrow 12 by continuously operated infeed conveyor 10. Several side-by-side lines of articles are being so fed, and the line pressure of the upstream articles in each line urges the articles across a horizontally extending deadplate 14. Lane dividers 15,15 are provided for maintaining the integrity of each line and would also be provided above the infeed conveyor as well. Means is provided above each line of articles to hold them back against the line pressure of the upstream articles as the conveyor 10 continues to operate, and preferably said means comprises individual braking means, indicated generally at 16, associated with each line. An inverted U-shaped framework 18 supports several article braking means, each of which includes a solenoid operated device 20, with an associated plunger 32, for operation of a brake shoe 24, provided for this purpose at the lower end of the plunger 22 and adapted to engage the upper end of the article on the deadplate 14 when solenoid A (FIG. 9) is energized. As shown in FIGS. 2 and 3 three such solenoid operated devices are provided on the U-shaped support 18 and each device is associated with one of three side-by-side lane.

It will of course be apparent that any number of article lines might be provided depending upon the lane defining structure used on the conveyor, and upon the size and configuration of the packing case to be loaded.

As best shown in FIG. 4, lane defining grid means is provided for receiving the three lines of articles shown. Preferably said means comprises four vertically extending lane defining plates 30, 32, 34 and 36. Thus, when the braking devices 16,16 are de-activated as for example when solenoid J in FIG. 9 is energized in response to closing of limit switch LS-6, the articles are adapted to be advanced by line pressure across the deadplates 14 and thence onto the horizontally extending floor defining portions 38, 39 and 40, 41 and 42, 43 of the grid structure, between the plates 30, 32, 36 and 36 thereof, until progress of these articles is prevented as a result of the laterally extending stop member 44. The articles actually engage vertically extending plates 45,45 in each of the three lanes, which plates 45,45 are mounted on the stop member 44. Limit switches LS-1, LS-2, and LS-3 are mounted on the rear surface of the stop member 44 and are adapted to being closed as a result of pivotal movement of a depending lever 46 associated with each lane. The lever 46 has lower end portion 48 which protrudes through an opening or slot 50 provided for this purpose in each of the plates 45,45 and it will be apparent from FIG. 5 that when an article A has engaged the upstanding plate 45 on the stop member 44 such articles will have moved the lever 46 from a position wherein it protrudes through this opening or slot to the position shown in FIG. 5 thereby closing limit LS-3. It will also be apparent that when all

three lane defining portions of the grid are so filled with articles that all three article detector switches LS-1, LS-2 and LS-3 will be closed in the same manner. From FIG. 9 it will be seen that when these switches are so closed not only is solenoid A operated or energized engaging the line brake 16 but solenoid B is also energized closing a series of doors best shown in FIG. 8 at 52, 54, 56 and 58 and to be described in greater detail hereinbelow. In addition, time delay relay TDR-1 is also energized at this point in the machine's cycle.

Means is provided for adjusting the position of the stop member 44 longitudinally of the lane defining grid means, and preferably said means comprises hand wheels 60,60 which are adapted to releasably clamp brackets 62,62 against the lane defining plates 30 and 36 at either end of the stop member to hold said member 44 at a particular longitudinal position so as to permit accommodating a given number, or size of articles A,A to be loaded. Thus, it will be apparent that merely loosening or unscrewing the hand wheels 60,60 permits the operator to slide the stop member to a desired setting in the longitudinal direction for accommodating the given numbers or sizes of articles to be loaded.

Still with reference to the lane defining grid means of FIG. 4, a U-shaped inner frame 66 has leg portions 74 and 78 extending in the upstream direction on either side of the lane defining structure described hereinabove, and supports said structure from a pair of angle members 68,68 extending inwardly therefrom and carried on the sides of the lane defining plates 30 and 36. The leg portions 74 and 78 of the U-shaped frame 66 are in turn slidably supported on longitudinally extending guides 70 and 72. FIG. 7 shows in detail the square cross section of the guide 72 and an associated bushing 73. These guides 70 and 72 are in turn supported from an outer frame 76, which outer frame in combination with the guide rods and a laterally extending cross beam 82 defines a closed rectangular shape.

The leg portions of the inner U-shaped frame 66 are thus slidably supported on the guide rods 70 and 72 respectively as a result of four slide bearings similar to the one shown in FIG. 7 so that the lane defining structure can be retracted from the position shown in solid lines to a position clear of the deadplates 14,14 as indicated by the phanthom lines in FIG. 4.

A short stroke linear fluid actuator motor 84 is mounted to the rectangular frame 76 and has its actuator 86 connected to the base of the U-shaped frame 66 for moving the U-shaped frame 66 between the solid line position shown wherein it is adapted to occupy a position in closely spaced relationship to the downstream end of the deadplates 14,14 and the phanthom line position suggested in FIG. 4 wherein the lane defining portion of the grid means is retracted clear of these deadplates 14,14 to separate the articles A,A in this area so that the structure just described can be rotated as suggested in FIG. 8.

Means is provided for rotatably supporting the U-shaped frame, and hence also the retractable lane defining portion of the grid means mounted thereupon, and preferably said means comprises a pair of longitudinally spaced bearings 90 and 92 which permit the inner U-shaped frame and the rectangular outer frame 76 to be rotated about an axis generally in line with the direction of movement of the articles on the infeed conveyor. This axis, indicated generally at 94 in FIGS. 1 and 4 is defined by a pair of stub shafts best shown in FIG. 1. The downstream shaft 96 carries a timing belt sprocket 100 on which a timing belt 102 is entrained. The timing belt 102 also passes over a drive sprocket 104 mounted on shaft 106, which shaft 106 comprises the output shaft of a rotary type fluid motor 108. The fluid motor is air operated in the clockwise direction under the control of solenoid H (FIG. 9) through limit switch LS-7, and is oscillatable in the counterclockwise direction under the control of solenoid D through time delay relay contacts TDR-1.

These contacts TDR-1 also control solenoid C, which in turn control the sliding movement of the lane defining portion of the grid described hereinabove. Preferably, the rotational movement of the grid is delayed slightly with respect to retracting the grid in order to provide a proper clearance between the articles on the deadplate 14 and the articles in the grid. It has been found that the inertia of the grid structure resisting rotational movement about the axis of rotation 94 is enough greater than the inertia provided against the sliding motion of the U-shaped frame 66 so that this delay is in effect obtained without resorting to any electrical or other form of delay. It will be apparent that flow control devices might be provided in the air line to the rotary air motor 108 in order to more positively prevent rotation of the grid prior to retraction without departing from the scope of the present invention.

A depending shield or shirt 112 is provided on the cross member 82 and will of course rotate with the grid structure to prevent articles on the infeed conveyor from being advanced by the line pressure onto the inverted grid structure in the event of failure of the brake means 16,16. As will be apparent from FIGS. 1 and 2 the skirt 112 will be rotated into an upright position upon inverting of the grid thereby preventing inadvertent release of the articles whenever the grid is so rotated to its inverted or discharge position.

Means is provided for retaining the charge of articles in the grid during rotation and preferably said means includes a linear fluid motor adjacent the downstream end of the lane defining portion of the grid for operation of the doors 52, 54, 56 and 58. Movement of these doors from the vertical or open positions shown in FIGS. 1 through 4, wherein they are aligned with their associated lane defining plates 30, 32, 34 and 36 respectively, to the closed positions shown in FIG. 8, is achieved through a linkage system connected to the doors and to the motor 120. The linear fluid motor 120 has its cylindrical base portion pivotally connected to a bracket 122 carried on the rear face of a plate 65 forming a part of the lane defining portion of the grid structure its actuating rod 164 is connected to a crank arm 166, which crank arm 166 is keyed to an associated rock shaft 168. As best shown in FIG. 1 the shaft 168 defines an axis coincident with the hinge line 170 of the door 58 associated with the lane defining plate 36. Thus, oscillation of the arm 166 causes oscillation of the door 58 in response to reciprocation of the actuating rod 164 of the fluid motor 120.

The remaining doors 52, 54 and 56 associated with the lane defining plates 30, 32 and 34 respectively, are

simultaneously operated by push rod **172** and links **174** and **176** best shown in FIG. 3. More particularly, the doors **58** carries a stub shaft **177** for pivotally supporting one end of the push rod **172**. The push rod **172** includes a rod end type bearing **178** rotatably supported on the stub shaft **177**. The lower end of the push rod **172** also carries a rod end bearing **180**, which is rotatably supported on the depending end of a crank arm **182** generally similar to the crank arm **166** described hereinabove. A rock shaft **184** is keyed to this depending crank arm **182** and oscillates on an axis coincident with the hinge line associated with the opposite door **52** on the lane defining plate **30** opposite the plate **36**. The two center doors **54** and **56** associated with lane defining plates **32** and **34** are operated in synchronism with the doors **52** and **58** by means of the cross links **174** and **176**. Thus, it will be apparent that the linkage mechanism just described serves to operate the doors between the closed positions shown best in FIG. 8 and the open positions wherein the articles A,A are adapted to free fall from the lane defining grid at least when said grid is rotated to its invert or discharge position.

When the lane defining grid structure just described has been rotated by the rotary air motor **108** to its invert, or discharge position, a limit switch LS-4 is closed energizing a solenoid E allowing air under pressure through a valve **190** to raise the lift table **192** mounted upon the upper end of an actuating rod **194** associated with a linear air cylinder **196**. When the packing case reaches its raised position, limit switch LS-5 will close energizing solenoid F allowing air under pressure through a valve associated with the linear actuator **120** just described for opening the doors **52, 54, 56** and **58**. Thus, when the packing case is arranged in position for receiving the upside down articles A,A the doors associated with retaining the articles in the inverted grid will open allowing the articles to free fall into the packing case C. As so constructed and arranged, these doors serve the function formally provided in a conventional series of funnels associated with a conventional grid for filling a compartmented packing case of the type indicated generally at C. More particularly, as these doors open the articles in their inverted positions are guided during their free fall into the packing case and thus remain under full control reducing the likelihood of breakage associated with conventional free falling of upright articles into such a packing case.

Simultaneously with the energizing of solenoid F associated with the operation of the actuator **120** associated with these doors, a time delay relay TDR-2 is energized so that after a predetermined time delay, that is, one of sufficient length to allow the articles to drop downwardly into the upwardly open packing case, the relay contacts TDR-2 will close energizing solenoid G associated with air valve **198** providing air under pressure to the opposite side of the air cylinder **196** to return the case lift table **192** from its raised to its lowered position. When the table has been lowered past some predetermined position limit switch LS-7 will be closed energizing solenoid H so as to cause the grid to rotate from its inverted to its article receiving position, and also energizing solenoid I causing linear actuator **84** to return the lane defining portion of the grid from its retracted position to its forward position adjacent the deadplates **14,14** in order to ready the structure for receiving a second charge of articles. Although the latter motion may occur prior to the former, no interference will be encountered because the grid contains no articles.

A second limit switch LS-6 associated with the rotating grid structure will be closed when the grid returns to its article receiving position causing solenoid J to be energized releasing the line brake actuators **20,20** allowing a second charge of articles to be fed into the grid structure. In order to cushion the **180** degree oscillating movement of the grid structure, two hydraulic shock mounts are provided, as indicated generally at **220** and **240**, adjacent the extreme edge portions of the rectangular outer frame **76** for cushioning the grid structure at its limit of travel in both directions. For example, the hydraulic shock mount **220** has a plunger **222** for engaging a fixed bracket **224** provided for this purpose in a fixed cross beam **226** in order to snub movement of the grid structure during its counterclockwise return travel from the invert to the article receiving position. This same bracket **224** will be engaged by a plunger **242** on the other hydraulic shock mount **240** when the grid structure has moved in a clockwise direction as indicated by the arrow **110** from the article receiving position to the invert position. The fixed cross member **226** carries the bearing **92** for rotatably supporting the shaft **96** associated with oscillating movement of the grid structure, and said cross beam **226** is supported at its extremities in any convenient structure, as for example the structure indicated generally at **244** and **246** respectively.

To summarize the operation of the above described device an infeed conveyor **10** is adapted to feed discrete lines of articles A,A in the direction of the arrow **12** across deadplate means **14** into the multi-lane defining portion of a rotary grid. structure capable of receiving a charge of articles. These articles are held in the grid structure by hinged doors adapted to engage the upper end portions of the articles. A series line brakes **16,16** are adapted to restrain those articles on the deadplate so as to prevent the line pressure of articles on the conveyor **10** from interfering with invert movement of the grid structure. The grid structure includes means for retracting those articles in the lane defining portion thereof so that the charge of articles can be rotated on an axis in line with the direction of movement of the articles on the conveyor through substantially 180° to an inverted position. This retract feature permits the line pressure of the articles A,A on the infeed conveyor to feed a charge of articles into the lane defining portion of the grid, and yet permits those articles in the grid to be freed from contact with the articles on the deadplate for rotation of the discharge position. When the charge or slug of articles in the grid structure has been rotated to the inverted or discharge position the doors are simultaneously opened allowing the articles to free fall into a packing case which has been positioned for receiving them. After a predetermined time delay, the packing case is lowered and the grid structure is returned to its article receiving position for accepting a second charge or slug of articles.

DETAILED DESCRIPTION OF THE SECOND PREFERRED EMBODIMENT SHOWN IN FIGS. 10—14

The previously described embodiment shown in the drawings in FIGS. **1** through **9** inclusively relates to an invert grid mechanism wherein a single lane defining grid means is provided adjacent the downstream end of a conveyor and is rotatably supported on a shaft in line with the direction of movement of the articles on the conveyor for movement between the first or infeed position shown in FIG. **1** to a drop or inverted position as shown in broken lines in FIG. **2**, and means is provided for sequentially oscillating the grid means between these two positions rotating said grid means alternately in a clockwise and a counter-clockwise direction. The embodiment to be described with reference to FIGS. **10** through **14** inclusively shows on the other hand two such grid means located in diametrically opposed relationship with respect to the axis of rotation of a frame in which both grid means are supported. For the sake of simplicity only the essential points of difference will be emphasized in the description to follow.

As shown in FIG. **10** an infeed conveyor **10** is adapted to feed articles (not shown) in the direction of the arrow **12** so as to feed several side-by-side lines of articles into the first lane defining grid means indicated generally at **200**. Line pressure of the articles on the infeed conveyor urge articles downstream thereof across a horizontally extending deadplate **14** between fixed lane dividers **15,15** into said lane defining grid structure **200**. A second lane defining grid means **300** is provided in a frame structure rotatably supported on a shaft means provided adjacent the downstream end of the conveyor **10** generally similar to the shaft means described hereinabove with reference to the FIG. **1** embodiment.

Means is provided in the fixed frame of the apparatus shown in FIG. **10** for holding back articles on the infeed conveyor, and more particularly said means comprises a solenoid operated device **20** having an associated plunger for operation of a brake shoe **24** provided for this purpose at the lower end of the plunger and adapted to engage the upper end of each article in each lane on the deadplate **14** when a solenoid A (FIG. **14**) is energized. As shown in FIGS. **2** and **3**, three such solenoid operated devices are provided on the U-shaped support **18** and each such device is associated with one of the three side-by-side lanes defined by the dividers **15,15**. The actual number of article lines provided on an apparatus of the present type will of course depend on the size and configuration of the packing case to be loaded.

As best shown in FIG. **11**, and as described hereinabove with reference to FIG. **4** in the first preferred embodiment, lane defining grid means is provided for receiving the three lines of articles shown, and preferably said means comprises four vertically extending lane defining plates **230**, **232**, **234** and **236**. Thus, when the first lane defining grid **200** is located in the first or infeed position shown in FIG. **10**, and when the line pressure of articles on the infeed conveyor has filled said grid with a predetermined number of articles in each of its lanes, solenoid A will be energized and the line brakes associated with each of the lanes on the deadplate **14** will be set. As in the previously described embodiment, and as shown in FIG. **11**, limit switches LS-1*a*, LS-2*a*, and LS-3*a* are provided for detecting the presence of such articles in each of the lanes in the grid **200**. Each of these limit switches are mounted on a fixed stop member **244** in which a plurality of vertically extending plates **245, 245** are movably mounted for actuation of each of the individual lane detector switches LS-1*a*, LS-2*a* and LS-3*a* through a lever **246** in the same manner as descrined hereinabove with reference to the FIG. **1** embodiment. As shown in FIG. **14**, these three series connected switches LS-1*a*, LS-2*a* and LS-3*a*, when closed, energize a control relay CR-1 which has normally opened contacts **278** for energizing the solenoid A which sets the line brakes mentioned previously.

Still with reference to FIG. **10** and FIG. **14**, each of the lane defining plates **230, 232, 234** and **236** carries adjacent its upper marginal edge a pivotally mounted doors **252, 254, 256** and **258** respectively, the operation of which doors is controlled by a pair of simultaneously actuated air motors **220, 220**. These air motors **220, 220** are controlled in their operation by a solenoid B which is energized through a second set of contacts **280** of relay CR-1 at the same time as solenoid A controlling the operation of the line brake described hereinabove with reference to the fixed deadplate **14**. In addition to energizing solenoids A and B, closing of the limit switches LS-1*a*, LS-2*a* and LS-3*a* and energizing of relay CR-1 also serves to energize a time delay relay TDR-1, which time delay relay has a pair of delayed contacts **282** which close after a predetermined time delay resulting in the energizing of solenoid C which controls a grid cylinder **284**, which cylinder performs the same function as the pancake cylinder **84** describer hereinabove with reference to the previous embodiment.

As best shown in FIG. **11**, a U-shaped frame **266** generally similar to the U-shaped frame **66** described with reference to the first embodiment has leg portions extending in the upstream direction on either side of the lane defining grid structure **200**, and supports the fixed frame of said structure from a pair of angle members **268, 268**. These angle members extend inwardly from the U-shaped frame and carry the lane defining side plates **236** and **230** respectively. Slide bearings are provided for slidably supporting the grid so that the lane defining grid structure **200** can be retracted from the position shown in solid lines to a position clear of the deadplate **14** as described hereinabove with reference to the first embodiment. The pancake cylinder **284** performs this function in the FIG. **10** apparatus.

As in the previously described embodiment means is provided for rotatably supporting the U-shaped frame, and hence also the retractable lane defining portion of the grid structure **200**, and preferably said means comprises a pair of longitudinally spaced bearings **290** and **292** generally similar to the bearings **90** and **92** described hereinabove. In place of the two stub shafts used in the previously described embodiment a longitudinally extending shaft **293** is provided for rotatably

supporting the grid structure and this shaft is oriented in the direction of movement of the articles on the infeed conveyor **10**. This shaft includes a projecting portion **295** which carries a timing belt sprocket **297** over which a belt is entrained. The timing belt **102** best shown in FIG. **12** corresponds to the timing belt **102** described hereinabove with reference to the previous embodiment. As described hereinabove the motor **108** oscillates the shaft **293** and with it the grid structure **200** between the position shown and a position 180° in the clockwise direction as viewed upstream in FIG. **12**, and oscillates said structure through the same 180° to return to the initial position shown. It is an important feature of the present invention that a second grid defining means indicated generally at **300** in FIG. **12** is provided in diametrically opposed relationship to the first grid **200** so that one of these grids is adapted to be receiving a group of articles while the second of such grids is adapted to be dropping a second charge of articles into an awaiting packing case located on a lift table as described above with reference to the first embodiment. Thus, the principal difference between the preferred embodiment shown in FIGS. **10** through **14** comprises the provision of a second article receiving grid portion which in effect doubles the handling capacity of a case packer of the type described herein. Whereas in the first embodiment shown in FIGS. **1** through **9** inclusively a depending shield or skirt **112** is provided for precluding the advancing of articles onto the grid structure when the grid structure is located in the drop position in the present embodiment described with reference to FIGS. **10** through **14** a second grid structure is provided precisely for receiving articles during this phase of the machine cycle.

The means for retaining the charges of articles in each of the grid structures **200** and **300** during rotation in the clockwise and counter-clockwise directions respectively includes pairs of fluid motors **220** and **320** the function of which pairs of motors is substantially identical to that of the fluid motor **120** described hereinabove with reference to the first embodiment. The movement of these doors is indicated schematically in FIG. **13**, which figure also shows for the inverted grid **300** a fixed funnel means **350** for guiding the downwardly dropped articles in the grid **300** into the upwardly open packing case C which case will have been previously positioned by a lift table or the like of the type described hereinabove with reference to the first embodiment (see FIG. **2**). The lengths of the various doors associated with each of the lane defining plates of the grid structures **200** and **300** preferably have a length which is determined by their distance from the center of rotation of the frame in which these grid structures are rotatably supported, and the upstream portions of the fixed funnel means **350** are preferably contoured to receive these doors as best shown in FIG. **13**.

Turning now to a more detailed description of the sequence of operation of the structure described hereinabove with reference to FIGS. **10** through **13** inclusively FIG. **14** shows a control circuit in schematic fashion suitable for operation of this apparatus. While some of the same identification numbers and letters have been used in FIG. **14** as used hereinabove with reference to the control circuit shown in FIG. **9** for operation of the apparatus shown in FIGS. **1** through **8** inclusively the circuit itself is somewhat more complex in that more relays are required as well as additional lane detection switches for use on each of the two grid structures **200** and **300**.

In the initial position shown in the drawings with the first grid structure in position for receiving a charge of articles from the infeed conveyor limit switches LS-1*a*, LS-2*a* and LS-3*a* will be closed, when the charge of articles has been received in the first grid **200**, resulting in energizing of solenoid A time delay relay TDR-1 and solenoid B. As mentioned hereinabove this serves to set the line brake associated with the fixed deadplate **14** as well as to close those doors associated with the first grid **200**. Time delay relay TDR-1 has associated therewith normally open contacts which will be closed upon the expiration of a predetermined time delay energizing solenoid C allowing fluid under pressure to contact the grid retract cylinder **284** to provide clearance between the articles on the deadplate **14** and those in the first grid structure **200**. When a case C has been provided on the left table limit switch LS-4 closes and clockwise rotation is possible at substantially the same time as the grid is retracted. The relative inertia of these motions permits such simultaneous initiation, but the grid retract will be accomplished before the clockwise rotation has been completed due to the relative inertia. While any convenient means might be used for raising the lift table **192** a solenoid J is provided for this purpose, and is energized when relay CR-7 is energized. Relay CR-7 is in turn controlled by contacts **284** of relay CR-5, which relay CR-5 is energized by closing of a limit switch LS-9 on the grid structure to indicate that the desired 180° of rotation has been completed. Thus, the lift table is raised when the first grid structure **200** has reached its inverted position.

When the lift table reaches its raised or "up" position, a limit switch LS-5 closes energizing relay CR-8. Normally closed contacts **286** associated with relay CR-8 open to deenergize relay CR-3. Contacts **288** associated with relay CR-3 open to deenergize solenoid B and cause the doors of grid **200** to open thereby releasing the slug of articles to free fall through the funnel **350** into the packing case C.

A time delay relay TDR-3 has timed contacts **290** which will open, upon the expiration of a predetermined delay following arrival of the lift table at its "up" position, and thereby deenergize solenoid J causing the lift table to descend. While the lift table is descending, another charge of articles is being loaded.

Time delay relay TDR-1 has contacts **292** which will have timed out upon the expiration of a delay following the closing of lane detection switches LS-1*a*, LS-2*a* and LS-3*q*. Thus solenoid A will be deenergized allowing a second slug or charge of articles to be fed into the grid structure **300** which is now located opposite the downstream end of the infeed conveyor **10**. Even as the line brakes are released, the fast acting grid retract cylinder is returned through a second set of timed contacts **294** associated with this relay TDR-2. The air lines to the line brake cylinders and to the retract cylinder are so designed that the grid is returned prior to release of the brake.

The second grid **300** is filled with articles and has associated lane detection switches LS-1*b*, LS-2*b* and LS-

3*b* which must be closed to energize relay CR-2. Relay CR-2, like relay CR-1, remains energized until relay CR-9 is energized so that reopening of these lane detection switches when the charge is dropped later in the cycle does not deenergize these control relays CR-1 and CR-2.

Relay CR-2 has contacts **296** which close to energize solenoid A resetting the line brake prior to retracting the grid, and rotating it in the counterclockwise direction. When limit switch LS-4 detects a second case on the lift table **192** solenoid E is energized to rotate the grid in the counterclockwise direction. As the original grid position is reached limit switch LS-9 recloses energizing relay CR-6. Contacts **298** of relay CR-6 energize relay CR-7 to raise the lift table and to start time delay relay TDR-2 for reopening its contacts **292** and **294**. The remainder of the machine cycle is similar to that described above, limit switch LS-5 recloses when the lift table has been raised to energize relay CR-8, deenergizing relay CR-3 opening contacts **288** of the latter deenergizing solenoid F to open the doors of grid **300**. Again, when time delay relay TDR-3 has timed out its contacts **290** allow the lift table to be lowered by deenergizing solenoid J, and relay TDR-2 will have also timed out reopening contact **294** returning the grid and rotating it clockwise as described above.

DETAILED DESCRIPTION OF THE THIRD PREFERRED

EMBODIMENT SHOWN IN FIGS. 15 & 16

FIGS. **15** and **16** show still another alternative for the single lane defining grid means of FIGS. **1–9** wherein the articles to be handled are not of the so called "narrow neck" variety shown in FIG. **8**, but are instead of the so called "wide mouth" type shown schematically at A3 in FIG. **16**. In handling the "wide mouth" containers a funnel **450** is preferably carried by the lane defining grid means, but is spaced from the hinged doors so as not to interfere with operation of these doors. In dropping "narrow neck" containers such a funnel is not required as shown in FIG. **8**, but in order to guide "wide mouth" articles into their proper cells in the packing case the use of a funnel has been found to be advantageous. A conventional funnel **450**, with conventional spring fingers, will guide these "wide mouth" articles during their free fall.

Relatively heavy wide mouth articles, such as glass jars, spread these spring fingers as they drop downwardly into the packing case. In fact, one reason for utilizing a funnel with resilient steel spring fingers is to decelerate the free falling jars during their descent to prevent damage to such glass articles. However, in handling light weight plastic articles of "wide mouth" configuration, the funnel serves only to guide the articles into the appropriate cell of the packing case. Further, the plastic "wide mouth" articles may not be heavy enough to spread the spring fingers and fall through the funnel. In this case a so called "push down" is preferably provided as shown in FIG. **16**, with a plunger for each article to move from the solid line position shown to the broken line position upon actuation of a single air cylinder. This cylinder is spring returned by means of an internal compression spring (not shown) and actuate by air through a solenoid valve (not shown) in response to energizing solenoid K in the schematic of FIG. **15**.

The FIG. **15** schematic is identical to that shown in FIG. **9**, but for the addition of solenoid K, which solenoid is energized when the drop doors are opened through solenoid F. In order to return the push down plungers when they have accomplished their function a normally closed limit switch LS-8 on the rotating grid is opened as the plungers reach the broken line position deenergizing solenoid K allowing the return spring to retract the plungers prior to closing of the doors.

We claim:

1. In an apparatus for depositing groups of articles into upwardly open packing cases, the improvement comprising an infeed conveyor for advancing the articles in a plurality of lanes, lane defining grid means for receiving a charge of articles when in a first position adjacent the downstream end of said infeed conveyor, means for rotating said grid means from said first position to a discharge position wherein the inverted charge of articles is free to fall downwardly into a packing case, means carried by said grid means for restraining said articles in said grid means comprising at least one door associated with each lane in said grid means, and means for moving all of said doors from closed positions wherein each engages an upper portion of the articles in its associated lane and an open position wherein the articles are free to fall inverted from the grid means when said grid means is in its discharge position.

2. The combination recited in claim **1** further characterized by means carried on said grid means for moving said doors between said open and closed positions.

3. The combination recited in claim **2** further characterized by shaft means for rotatably supporting said grid means for movement about an axis generally in line with the direction of movement of the articles on said infeed conveyor.

4. The combination recited in claim **3** further characterized by means for sliding said grid means axially on said shaft means, and means for holding back the articles on said conveyor while said grid means is shifted axially in the downstream direction, said axial shifting being carried out prior to rotation of said grid means from said first position to said discharge position.

5. The combination recited in claim **4** further characterized by means for detecting the presence of a predetermined number of articles in the lanes of said grid means, and means responsive to said detecting means for applying said holding means to the articles on said conveyor and for closing said doors.

6. The combination recited in claim **5** further characterized by means responsive to the rotation of said grid means to its discharge position for elevating a case to receive said inverted articles.

7. The combination recited in claim **6** further characterized by means responsive to the elevation of said case to open said doors and allow the inverted articles to free fall into said case.

8. The combination recited in claim **7** further characterized by timed means for lowering the filled case after a predetermined time following the opening of said doors.

9. The combination recited in claim 8 further characterized by means responsive to the lowering of said filled case for rotating said grid means back to its first position.

10. The combination recited in claim 9 further characterized by means responsive to the rotation of said grid means to its first position for releasing said article holding means on said conveyor so that the line pressure of the articles thereon causes another charge of articles to be fed into said lane defining grid means.

11. The combination recited in claim 2 further characterized by second lane defining grid means mounted to said first lane defining grid means for rotation therewith, said second lane defining grid means occupying said first position when said first grid means is in said discharge position and said second grid means occupying said discharge position when said first grid means is in said first position.

12. The combination recited in claim 11 further characterized by second means carried by said second grid means for restraining articles therein during rotation and for releasing articles for free fall therefrom at said discharge station, said second means for restraining articles in said second grid means comprising at least one door associated with each lane in said second grid means, and means for moving said doors on said second grid means.

13. The combination recited in claim 12 further characterized by shaft means for rotatably supporting said first and second grid means for movement about an axis generally in line with the direction of movement of the articles on said infeed conveyor, means for sliding said first and second grid means axially on said shaft means, and means for holding back the articles on said infeed conveyor while said first and second grid means is shifted axially in the downstream direction, said axial shifting movement being carried out prior to rotation of said grid means between said two positions.

14. The combination recited in claim 12 further characterized by means for elevating a case to receive said inverted articles at said discharge position, said case elevating means being carried out after rotation of said grid means between said two positions.

15. The combination recited in claim 14 further characterized by fixed funnel means for guiding the falling articles at said discharge station, and means responsive to the elevation of said cases to open said doors of the grid means at said discharge station to allow the inverted articles to free fall downwardly through said fixed funnel means into said upwardly open case.

16. The combination recited in claim 15 further characterized by timed means for lowering the filled case after a predetermined time following opening of said doors.

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