This invention relates to a machine for palletizing and depalletizing cans and other containers.

A primary object of the invention is to provide a machine including a bin which is supported for rocking movement between an upright and tilted position, and which bin is adapted to receive and support a pallet to receive cans or other containers during a palletizing operation, or from which cans or other containers are removed during a depalletizing operation of the machine.

More particularly, it is an object of the invention to provide a tilt bin having conveyor means to facilitate movement of a full or empty pallet into or from the tilted bin, and for supporting the pallet with a portion thereof in a lift structure by which the pallet is raised and lowered within the bin.

Another object of the invention is to provide a machine including a tilt bin having a conveyor carried by a top portion thereof for restricting and regulating the gravity feed of a tier of cans into the tilted bin and onto the pallet or onto a previously deposited tier of cans.

Still another object of the invention is to provide a tilt bin structure wherein said top conveyor additionally functions for sweeping a tier of cans from the tilted bin in the depalletizing function of the machine.

Still another object of the invention is to provide a machine including an auxiliary frame disposed to receive cans or containers which are swepted from a top tier of palletized cans supported in the tilted bin by said top conveyor of the tilted bin, and which auxiliary frame includes means for conveying the depalletized cans laterally away from the machine.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

**FIGURE 1** is a side elevational view of the complete machine in one position of the parts thereof during operation of the machine;

**FIGURE 2A** is an enlarged vertical view of the forward part of the machine, taken substantially along a plane as indicated by the line 2A—2A of **FIGURE 5**;

**FIGURE 2B** is a longitudinal vertical sectional view of the remaining rear part of the machine and with the parts in positions corresponding to the positions of **FIGURE 2A**, and taken substantially along a plane as indicated by the line 2B—2B of **FIGURE 6**;

**FIGURE 3A** is a view similar to **FIGURE 2A** but illustrating a different position of the parts of the machine as illustrated therein;

**FIGURE 3B** is a view similar to **FIGURE 2B** but showing the machine with the parts positioned as in **FIGURE 3A**;

**FIGURE 4A** is a view corresponding to **FIGURE 2A** and illustrating a third position of certain of the parts of the machine;

**FIGURE 4B** is a view similar to **FIGURE 3B** but with the machine parts positioned as in **FIGURE 4A**, to illustrate another operation of the machine;

**FIGURE 5** is a fragmentary top plan view of a part of the machine as illustrated in **FIGURES 2A, 3A** and 4A;

**FIGURE 6** is an enlarged fragmentary cross sectional view taken substantially along a plane as indicated by the line 6—6 of **FIGURE 2A**;

**FIGURE 7** is an enlarged fragmentary horizontal sectional view taken substantially along a plane as indicated by the line 7—7 of **FIGURES 2A** and 2B;

**FIGURE 8** is an enlarged detailed vertical sectional view of a part of the structure as seen in **FIGURES 3A** and 3B;

**FIGURE 9** is a fragmentary transverse sectional view taken substantially along a plane as indicated by the line 9—9 of **FIGURE 2B**;

**FIGURE 10** is a fragmentary transverse sectional view taken substantially along a plane as indicated by the line 10—10 of **FIGURE 2B**;

**FIGURE 11** is a diagrammatic view illustrating the hydraulic system of the machine;

**FIGURES 12A** and 12B are diagrammatic views illustrating the electric circuits of the machine.

Referring more specifically to the drawings, the container palletizing and depalletizing machine in its entirety and as illustrated in **FIGURE 1** is designated generally 15 and includes a main frame, designated generally 16, composed of a near or right side 17, as seen in its entirety in **FIGURE 1**, and a far or left side 18, partly seen in **FIGURE 2B**. The frame sides 17 and 18 are connected by cross braces 19, 20 and 21. Each frame side includes a base member 22, a top member 23 and three uprights 25, 25 and 26 which extend between and are secured to said members 22 and 23. As seen in **FIGURE 1** and **FIGURE 2B**, the rear uprights 26 extend to substantially above the top members 23. The top frame members 23 support bearings 27 which are secured thereto and in which are journaled trunnions 28 which are fixed to and project laterally from opposite corresponding sides 29 and 30 of a tilt bin, designated generally 31, and which trunnions 28 are disposed in alignment with one another.

The bin sides 29 and 30 each includes a frame, designated generally 165, having a rear upright 166 and a front upright 167. The frame 165 includes diagonally disposed cross members 168. The trunnions 28 project from the cross members 168 at the points of intersection thereof. Each bin side 29 and 30 also includes a wall 169. The bin 31 also includes a rear wall 170, as seen in **FIGURE 2B**, which extends between the rear corners 166.

The bin 31 includes a bottom 171 which is connected to and extends between the bottom portions of the frames 165 of the bin sides 29 and 30 and which includes corresponding side portions 172 and an intermediate portion 173 which is downwardly offset relative to said side portions. The portions 172 and 173 each extends from front to rear of the bin 31. Each of the portions 172 supports a roller conveyor, designated generally 174, which extends from front to rear of the bin and which is composed of transversely spaced substantially parallel sides 175 which are secured to and disposed on the bottom portion 172 thereof, and a plurality of rollers 176 which are rotatively supported between the sides 175 and which include upper portions which protrude above the upper edges of said sides. A fluid pressure actuated solenoid lift, designated generally 177, is mounted on the downwardly offset bottom portion 173 and in a retracted position, as seen in **FIGURE 6**, has its top sur-
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3. The scissors lift 177 will hereinafter be described in detail. Referring to FIGURES 1 and 4B, the corner posts 166 and 167 extend upwardly to above the upper edges of the side walls 169, and each frame 165 includes a top bar 206 which extends between the corner posts 166 and 167 thereof. Crossbars 179 extend between the front corner posts 167 and the rear corner posts 166. The bin 31 includes a top wall 189 which is disposed between the frame sides 165 and which is secured to the undersides of the cross members 179. The rear ends of the frame members 178 are pivotally connected with brackets 181 which support bearings 182 which are located behind the rear corner posts 166 and which journal a shaft 183 which extends therebetween. Sprocket wheels 184 are fixed to the shaft 183, between and adjacent the bearings 182, and a smaller sprocket wheel 185 is fixed to the shaft 183 between one of the sprocket wheels 184 and the adjacent bearing 182. A roller 186, at least the periphery of which is formed of rubber or other yieldable material, is fixedly disposed on the shaft 183 between the sprocket wheels 184.

Bearings 187 are secured to the upper side of the top plate 207. The forward edges of and between the front corner posts 167 to provide journals for a shaft 188 to the ends of which are fixed sprocket wheels 189. The sprocket wheels 189 align with the sprocket wheels 184 and endless chains 190 are trained over said aligned sprocket wheels. Two pairs of angular cleats or sweep members 191 extend between and are secured to complementary portions of the two chains 190 and are located with respect to one another, as seen in FIGURES 1 and 4B. As seen in FIGURE 4B, the bottom flights of the chains 190 and the sweep members 191 carried thereby travel along the underside of the top wall 189 and between the posts 166 and 167 of the two frames 165.

As seen in FIGURES 1 and 4A, the two rear corner posts 165 have rearwardly extending brackets 192 supporting bearings 193 which journal a shaft 194. A roller 195, corresponding to the roller 186, is fixed to the shaft 194, and a sprocket wheel 196 is fixed to the shaft 194 between the bearings 193 of the frame side 30 and the adjacent end of the roller 195. A hydraulic motor 44 is supported by the rear wall 170 and drives a sprocket wheel 197. An endless chain 45 is trained around the sprocket wheels 197 and 185 and also meshes with the sprocket wheel 196 for driving the rollers 196 and 195 in opposite directions, as indicated by the arrows 198 and 199, respectively, in FIGURE 4B. The sprocket wheels 184 and 189 turn in the same direction as the sprocket wheel 185, as indicated by the arrow 195, so that the bottom flights of the chains 190 travel from front to rear of the bin 31 or from left to right of FIGURE 4B.

As best seen in FIGURE 7, the scissors lift 177 includes an elongated rectangular bottom frame 220 the vertical sides 261 of which have inwardly extending bottom flanges 202. The scissors lift 177 includes a top plate 203 having transversely spaced depending flanges 204 which are spaced from the side edges thereof. Two pairs of lift arms are provided between the bottom frame 220 and the top plate 203. The outer pair of lift arms 205 straddle the inner pair of lift arms 206. The outer lift arms 205 and the inner lift arms 206 are rigidly connected together adjacent their forward ends by a cross brace 207 which extends between the bottom edges of the arms 205 and under the arms 206. The inner arms 206 are rigidly connected together, most notably from the lower ends thereof, by an upwardly offset cross brace 208. The rear ends of the scissors arms 205 and 266 are pivotally connected to 210 to the flanges 204 and the rear ends of the scissors arms 206 are pivotally connected at 314 to the rear ends of the side members 201. The forward ends of the arms 205 have rollers 213 which ride on the flanges 202 and the forward ends of the arms 206 have rollers 213 which ride on the bottom edges of the flanges 204. A hydraulic cylinder 24 is secured to the cross brace 228 and the cylinder piston 214 is pivotally connected at 215 to a forwardly offset portion 216 of the cross brace 207. The cylinder 24 is inclined downwardly from the cross brace 208 when the scissors lift 177 is in a fully retracted position.

One end of a hydraulic cylinder 12 is pivotally connected to the intermediate bottom cross brace 19 and has a forwardly extending piston rod 218 which is pivotally connected at 219 to the bottom frame 171. A palletizing frame, designated generally 220, is composed of sides 221 and 222 which are spaced apart a distance corresponding to the spacing between the sides 17 and 18. The frame 220 is positioned to abut the forward end of the frame 16 with the side 221 aligning with the side 17 and the side 222 aligning with the side 18, and said frame 230 is secured to the frame 16 by a suitable fastening means 65. Each of the frame sides 221 and 222 includes two uprights 223 and 224 which extend along the remainder of the frame, as seen in FIGURE 1.

Cross braces 225 extend between the uprights 223 and laterally outward therefrom and cross braces 226 extend between and to beyond the uprights 224. The complementary ends of the braces 225 and 226 provide supports and journals for shafts 237 and 239 carrying pulleys or the like 229 about which are trained an endless conveyor 230. A hydraulic motor 35 is supported by the upright 223 of side 224 and is connected by a sprocket wheel and chain drive 36 to the shaft 227 for driving the endless conveyor 230.

A downwardly inclined chute 231 has a bottom 232 and side wall 233 which terminate over the end of the conveyor 239 which is trained around the pulley of shaft 227. As seen in FIGURE 5, the bottom 232 is flared adjacent said terminal end and the other side wall 234 of the chute includes an upwardly offset portion 235 which extends beyond said flared end of the bottom 232 and which is upwardly offset from the upper flight of the endless conveyor 230.

Bearings 236 project laterally from the member 226 to support a journal 237 and a vertical shaft 238. The shaft 237 is connected by a bevel gear drive 239 (FIG. 1) to the shaft 227. An endless chain 240 is trained around sprocket wheels 241 which are fixed to the shafts 237 and 239, and said chain has outwardly projecting lugs 242. The chain and lugs carried thereby travel in directions as indicated by the arrow 243 of FIGURE 5 so that the lugs 242 along the inner flight of the chain travel over a side edge of the upper flight of the conveyor 239, between the wall 233 and a vertical wall 244 which rises from a part of the cross member 226.

A brace structure 245 extends laterally from the cross members 225, in a direction away from the conveyor 239, as seen in FIGURE 1, to provide a support for a hydraulic cylinder 2 and two tubular guide members 246 which straddle said cylinder, as best seen in FIGURES 2A and 5. Rods 247 extend sidewardly through the guides 246 and have inner ends secured to a sweep member 248, which in its retracted position is visible in FIGURE 5 between the upper cross member 226 and in alignment with the wall 244. A piston rod 249 extends through the hydraulic cylinder 2 and is connected to the piston thereof, not shown, and has an inner end connected to the sweep member 248. The outer ends of the rods 247 and 249 are secured to a cross member 258 to insure movement of said rods in unison with one another, and which cross member is mounted for sliding movement between two guide members 251 which project laterally from the upper cross member 226.

A platform, designated generally 253, comprises spaced
substantially parallel side members 253. A plurality of rollers 254 extend transversely between and are journaled by said sides 253 and are disposed so that coplanar portions of the rollers 254 are positioned slightly above the level of the members 253. As indicated in FIGURE 5, a flat plate 255 may be substituted for the rollers 254, depending upon the type of containers being palletized. As seen in FIGURE 2A, a rod 256 which is supported by the uprights 253 extends through bearing members 257 which are secured to the undersides of the members 253, for pivotally supporting an inner end of the platform 252 adjacent the upper cross member 225 and the side of the conveyor 230, located adjacent thereto. As seen in FIGURE 3A, the platform 252 has side walls 258 which are supported by and rise from the side members 253. Hydraulic cylinders 259 are pivotally connected to and extend upwardly from the frame sides 221 and 222 and have upwardly extending piston rods 259 which are pivotally connected at 260 to the members 253 for supporting the platform 252 in either an elevated substantially horizontal position, as seen in FIGURE 2A, or in an inclined position as seen in FIGURES 1 and 3A.

The platform 252, as best seen in FIGURE 8, includes a plate 261 forming a bridge member and which has depending side flanges 262 which engage between outer ends of the sides 233 and are pivotally connected thereto by pivot pins 263. A roller 254 is journaled between inner ends of the flanges 263 and beyond an inner edge of the plate 261. A rod 264 extends between and through outer portions of the flanges 262, for a purpose which will hereinafter become apparent. Pulleys 265 are anchored to the members 253 and are connected to the flanges 262 for causing said flanges and the parts carried thereby to rock clockwise about the pivots 263 for elevating the roller 254 carried by the flanges 262 to its dotted line position of FIGURE 8, above the level of the other rollers, to provide a container stop.

As best seen in FIGURES 1, 2B, 3B and 10, a de-palletizing unit, designated generally 266, includes a frame 275 which is swingingly supported by pivot elements 268 on the upper ends of the rear corner posts 26, so as to be disposed behind the frame 16. Slotted braces 269 are pivotally connected at 270 to the frame 267 and are adjustabley connected by fastenings 271 to the corner posts 26 for supporting the frame 267 at a desired incline, as seen in FIGURES 1, 2B, 3B and 272 are journaled on the ends of the frame 267 and each supports two grooved pulleys 273. Two belts 274 are trained around the aligned pulleys 273 of the two shafts 272. The frame 267 supports spaced substantially parallel walls 275 and 276 which define an upwardly opening channel therebetween and which walls straddle the upper flights of the endless belts 274 and upper portions of the pulleys 273. A hydraulic motor 43 is mounted on one end of the frame 267 and is connected by a sprocket wheel and chain drive 277 to one of the shafts 272 for driving said shaft and its pulleys 273 and the other shaft 272 and the pulleys 273 thereof through the endless belts 274.

Assuming that the machine 15 is to be used for de-palletizing, the bin 31 is positioned in an upright position, as seen in FIGURE 2B with the lift 177 fully retracted. Two roller tables 38 are positioned within the frame 220 in front of and in alignment with the roller conveyors 174. These roller tables 38, as seen in FIG. 1, are supported by legs 278 and are of a height and width corresponding to the roller conveyors 174, so that a pallet 279 can be supported on the rollers of the two tables 38. The pallet 279, as shown in FIGURES 2B and 4B would include a pair of bins 280, separated by separator plates or sheets 281. The fully loaded pallet 279 would then be pushed from left to right on the tables 38 through the open front of the bin 31 and onto the roller conveyors 174, as seen in FIGURES 2B and 6. With a leading sweep member 191 of a pair of said sweep members disposed under the sprocket wheels 189, the hydraulic cylinder 24 is pressured to elevate the lift 177. Since the pallet 279 while resting on the roller conveyors 174 is separated by the retracted lift 177, as seen in FIGURE 6, when the cylinder 24 is pressured to extend the lift 177, the top plate 293 of the lift will rise into engagement with the underside of the pallet 279 for elevating said pallet and the tiers of containers 280 which are supported thereon. The lift 177 is elevated until the upper tier of cans 280 is substantially in contact with the top plate 290 of the bin 31. The hydraulic cylinder 12 is then pressured for rocking the bin 31 clockwise about its pivots 28 from its position of FIGURE 2B to its position of FIGURE 4B. The braces 269 are clamped to the rear posts 26 by the fastenings 271 to support the de-palletizing unit 266 at a desired angle as seen in FIGURE 4B. Fluid pressure is furnished to the hydraulic motor 43 for driving the sprocket wheels 277 in a desired direction so that the upper flights of the conveyor belts 274 will travel in either direction desired between the walls 275 and 276. Fluid pressure is also supplied to the hydraulic motor 44 for driving the sprocket wheel 177 and the chain 190 and the roller 195 will turn in the direction as indicated by the arrow 198 and the roller 195 will turn in the opposite direction as indicated by the arrow 199. The rear wall 170 of the bin terminates below the level of the top plate 280 to provide an upper rear opening 282 at the rear of the bin 31, and a plate 283 extends rearwardly across the bottom of said opening 282 to the periphery of the roller 195. As the chains 190 are driven, the leading sweep member 191 on the bottom flight of said chains enganges the cans 280 of the forwardmost row of cans of the top tier to push the top tier of cans rearwardly, so that the transverse rows of cans of the top tier, commencing with the rear row thereof, pass through the opening 282 and off of the plate 283 into engagement with the oppositely revolving metering rolls 186 and 195 which feed the rearmost row of cans from the bin 31 and discharge said cans into the upwardly opening channel formed by the walls 275 and 276. The row of cans fall between the walls 275 and 276 and come to rest on their sides on the upper flights of the belts 274 which convey the cans longitudinally of the unit 286 for discharge from one or the other ends of said unit, toward which the upper flights of the belts 274 are traveling. The cans 280 which are thus deposited may be carried away from the unit 286 on any suitable chute or other conveyer, not shown, disposed beyond the end of the frame 267 toward which the cans are moved.

After the top tier of cans have thus been removed from the bin 31 and depalletized, the uppermost separator 281 is removed and may be placed upon a rack 284 which is mounted between and secured to the uprights 223 and 224, as seen in FIGURE 1, for example. The hydraulic cylinder 12 is then pressured at its outer end and de-palletizing at its inner end for causing the bin 31 to rock counterclockwise, as seen in FIGURE 2B, to an upright position. The hydraulic cylinder 24 is then further pressured to elevate the pallet 279 sufficiently to elevate the then uppermost tier of cans 280 to a position directly beneath the top wall 180, after which the inner end of the cylinder 12 is again pressured to tilt the bin 31 back to its position of FIGURE 6, repeating the de-palletizing operation previously described.

After the bottommost tier of cans 280 have been de-palletized in the aforesaid manner, the bin 31 is returned to an upright position and the lift 177 is returned to a fully retracted position by depressurizing the hydraulic cylinder 24, so that the pallet 279 rests upon the two roller conveyors 174, as seen in FIGURE 6.

Two roller tables 42, one of which is seen in FIGURE 4B, may be positioned to extend outwardly from the
The limit switch 83 energizes unlatching relay coil 124 of relay 115 and energizes relay 123 whereby the solenoid 147 of the valve 66 is energized for bleeding the cylinder 24 to allow the lift 177 to retract to its lowermost position, at which time the limit switch 83 is energized and energizes the unlatching coil 156 of relay 125 for moving the valve 66 to a neutral position.

The pallething function of the machine 15 is commenced with the platform 252 in its raised position of FIGURES 4A and 5. Containers 280 are fed by gravity down the inclined chute 231 to the rear of the frame 16 so that the unloaded pallet 279 may be pushed rearwardly on the roller conveyors 174 through a bottom opening 285 of the rear wall 170 and onto the roller tables 42 from which the empty pallet can be conveyed away from the machine 15. This is advantageous since another full pallet may have been placed upon the roller tables 38 prior to completely depalletizing the containers on the pallet 279 located in the bin, and so that immediately after the empty pallet 279 has been removed from the bin 31 through its bottom rear opening 285, another loaded pallet may be conveyed from the tables 38 through the open front of the bin 31 and onto the roller conveyors 174, for repeating the depalletizing operation.

An operator's platform 39 is secured to the frame 16, preferably to the side 23 thereof, and a console or cabinet 57 is also secured to said frame side and to the platform or stand 39. The machine 15 is electro-hydraulically operated, depending solely on electricity as the only external source of power and control coupled to a closed hydraulic system which includes a pump, cylinders, motors and valves. A major portion of the hydraulic system is contained in the console or cabinet 37, and this likewise applies to most of the electrical system. In accomplishing the depalletizing operation, previously described, an operator on the stand 39 closes a switch 159 on the console 37 to complete an electric circuit to an electric motor 75 (FIGURES 11 and 12A), and also closes a switch 166 to warm up photoelectric cells 49, 50, 51 and 54 (FIGURES 1 and 5). Switch 161 is actuated to select automatic; switch 162 is actuated to select depalletize, and switch 158 is actuated to select either right or left discharge of the depalletized cans from the unit 266. A pushbutton 116 is actuated to energize a latching type relay 118 which closes a contact 129. Since contact 130 and photoelectric cell 50 are in circuit closing positions, this will energize solenoid 146 of valve 66 so that hydraulic fluid will be supplied by the pump 74 from the reservoir 73 to pressurize the hydraulic cylinder 24 and thus elevate the scissors lift and the pallet of cans contained therein. The top row of containers 280 is detected by the photoelectric cell to break the circuit of the solenoid 146 to close the valve 66 and interrupt upward movement of the scissors lift when the top tier of containers 280 are in the position as seen in FIGURE 4B. The photoelectric cell 50 also functions at the same time by the closing of its contacts 128 and 132 to energize contact 119 to open the contact 130 and close contact 132. A solenoid 148 of the valve 67 is energized by the closing of contact 132 so that the hydraulic fluid is supplied through said valve to the lower end of the cylinder 12 to effect tilting of the bin 31 until the switch 41 is engaged by one of the members 160 for energizing relay coil 121. This closes relay contacts 144 for energizing the solenoid 154 of valve 72 for supplying hydraulic fluid to the motor 44 for driving the chains 190 and rollers 186 and 195, as previously described, to effect removal of the top tier of cans 280 from the bin 31. The sweep member 191 which is pushing the top tier of cans 280 on the roller 46 (FIGURE 1) to energize relay coil 123, the contacts 134 of which energize the solenoid 149 of valve 67. Actuation of the switch 48 also causes solenoid 154 to be de-energized for interrupting operation of the motor 44. When solenoid 149 is energized fluid is supplied to the upper end of the cylinder 12, and the fluid is supplied from the lower end thereof to cause the bin 31 to rock back to an upright position. When this has been accomplished, another frame member 138 engages the switch 40 to break contact 122 and close contact 131, to de-energize solenoid 149 and to again energize coil 145 of valve 66 to again pressurize the cylinder 24 for further lifting the scissors lift 177.

The aforesaid cycle of operation is repeated until the scissors lift 177 reaches its maximum height, when
3,200,969 upright position and the lift 177 is lowered sufficiently so that a separator 281 when placed upon the top of the previously palletized tier of cans will be at approximately the level of the uppermost separator 281 as seen in FIGURE 31. After the separator 281 may be returned to its upright position, as hereforeto described. The operation previously described is then repeated for reloading the platform 252 preparatory to discharging another tier of cans into the bin 31, as previously described. When the pallet 279 has been filled with approximately six tiers of cans, and after the bin 31 has been returned to an upright position, the lift 177 is closed so that the pallet is supported on the conveyors 174. The loaded pallet is then removed through the open front of the bin 31 onto the tables 38, preparatory to repeating the palletizing operation.

The aforesaid palletizing operations can be accomplished by an operator on the stand 39 who actuates the switches 159 and 160 to complete the electric circuit to the motor 75 and to warm up the photoelectric cells 49, 50, 51 and 54, respectively, as previously described. The switch 161 is actuated to select automatic operation and the switch 162 is moved to a palletizing position. Assuming that the photoelectric cell 54 (FIGURE 5) has a broken beam due to the chute 231 being filled by containers 280, and that the pusher member 248 is retracted as seen in FIGURE 5 against the switch 159, and that the limit switch 55 is closed due to not being engaged by a container 280, when the switch 162 is actuated as aforementioned, the relay coil 112 is energized for closing contacts 144 to thus energize solenoid 155 of valve 70 to supply hydraulic pressure to operate the motor 35 for driving the endless conveyor 230 and the conveyor 240, as aforementioned, to move two rows of cans 280 across the puncher member 248. A leading can 280 strikes the switch 55 for breaking the circuit of the coil 112 and thus de-energizing the solenoid 155 to stop operation of the motor 35 and for completing an electric circuit including the switch 33 (FIGURE 1) and relay 113. Solenoid 152 of valve 68 is energized by contacts 141 of relay 113 to pressurize the left hand end of cylinder 2 (FIGURE 5) so that the puncher element 248 is displaced from left to right for moving the cans onto the platform 252, as previously described, and which can only be accomplished if the platform is in a raised position and in engagement with the switch 162. When 248 is fully extended the member 250 will engage and actuate the switch 58 causing relay coil 114 to be energized and close contact 242 for energizing the solenoid 153 of valve 68 to thereby pressurize the right hand end of the cylinder 2 and allow the cylinder to be bled from the left hand end thereof through the valve 68 for returning the puncher element 248 to its position of FIGURE 5. The aforementioned cycle of operation is repeated automatically until the platform 252 is completely loaded and the leading row of cans 280 breaks the beam of the photoelectric cell 51 (FIGURE 5) and closes contact 93, or the photoelectric cell 54 breaks the circuit due to the fact that the cans cease to be backed up on the chute 231.

At the same time that the operator actuates the switch 162 to select palletizing, he actuates pushbutton 84 which produces an electric pulse in relay 104 to close contacts 87 and 135. This completes the circuit 86, 87 for holding the relay 104 so that the pushbutton 84 can be released. The solenoid 147 of valve 66 is thus energized for pressurizing the cylinder 24 to extend the lift 177 until the circuit 86, 87 is broken by the photoelectric cell 49 detecting the top of the pallet 279 for de-energizing solenoid 147 to cause the valve 66 to assume a closed extended lift 177 immediately to hold the platform 252. This also causes contact 88 to be closed and relay coil 105 to be energized for closing contact 137 to energize the solenoid 148 of valve 67, thereby pressurize the lower end of the cylinder 12 to move the bin 31 to its tilted position and until the switch 41 is actuated thereby, as previously described, to stop the tilting movement of the bin. This movement of the bin 31 to a tilted position can occur only if the photoelectric cell 51 has detected a fully loaded platform 252 for closing contacts 93 to energize coils 107 and 108. The energizing of relay coil 107 completes contacts 90 and 91 and breaks contact 89 while the energizing of relay coil 108 completes contacts 94 and 140. Contact 140 energizes solenoid 151 of valve 69 to bleed the lower ends of the cylinders 55 for lowering the platform 252. Movement of the platform 252 to its position of FIGURE 1 actuates switch 34 for closing contact 143 to energize solenoid 154 of valve 72 to supply fluid to the motor 44. The cans 280 are led onto the pallet by the sweep member 191 immediately in advance thereof, as seen in FIGURE 38 and as previously described, until the beam of the photoelectric cell 51 is completed, by the platform 252 being emptied of cans. and the sweep 191 actuated to initiation the switch 48 to de-energize the solenoid 154 to stop the motor 44 and to complete a circuit, as previously described, for pressurizing the outer end of cylinder 12 and for bleeding the inner end thereof for returning the bin 31 to an upright position. This is accomplished by the solenoid 148 of the valve 67 being energized. When the beam of the photoelectric cell 51 is completed, as just previously mentioned, contact 96 is completed to energize relay coil 110 which causes solenoid 150 of valve 69 to be energized for pressurizing the lower ends of the cylinders 5 to elevate the platform 252. This causes limit switch 33 to be actuated by the raised platform 252 to energize coil 106, so that the solenoid 145 is not energized, for returning the bin to an upright position, until the platform 252 is in a fully raised position. The raising of the platform 252 and the actuation of the switch 33 thereby causes the cans to again be conveyed by the conveyor 230 and displaced onto the platform 252 therefrom by the puncher element 248 to re-load said platform, as previously described.

Swinging of the bin 31 back to an upright position causes switch 40 to be actuated which energizes coil 111 and completes contact 136 for energizing solenoid 146 of valve 66 for bleeding cylinder 24 to lower the lift 177 until the top tier of cans passes below the level of the photoelectric cell 49 so that the beam thereof is completed to close contacts 88 and 90 which are held by the latching type relay 107. Coil 105 is also energized to complete contact 137 which energizes solenoid 148 of valve 67 to cause the tilt bin 31 to resume its tilted position, preparatory to the platform 252 again moving to a lowered position and discharging another tier of cans into the bin. Before the new tier of cans is discharged, the operator from the stand 39 removes a separator 281 from the rack 284 and places it upon the topmost previously deposited tier of cans. The aforementioned cycles of operation are repeated automatically until the pallet 279 is completely loaded at which time the switch 127 (FIGURE 1) is actuated to energize the unlatching relay 115.

The hydraulic circuit as shown in FIGURE 11 includes a reducing valve 77, of conventional construction, to reduce the pump pressure from 1500 p.s.i. to 900 p.s.i. for all of the system except the lift cylinder 24. Conventional flow regulator valves 76 are provided for controlling the rate of flow to the hydraulic cylinders and hydraulic motors and the speed of the lift. The valves 66-72 are of the conventional four-way solenoid operated, spring centered type, capable of functioning to block all parts in a neutral position or for connection to the reservoir 73.

As previously described, the motor 44 is capable of functioning as a pump when connected to the valve 115 rather than by the fluid supplied thereto for rearming movement of a tier of cans into the bin 31 during the palletizing operation. The fluid circuit between the valve 72
and motor 44 includes check valves 79–82 and a pressure control relief valve 78 to control the induced pumping action of the motor 44 caused by the gravitational force of the cans which is opposed by one or more sweep members 191, and to relieve the shock when the valve 72 is closed and which would be injurious to the cans. Accordingly, if the fluid had been flowing from left to right of FIGURE 11 through the motor 44, when the valve 72 is closed, the fluid is bypassed through check valve 79 and relief valve 78 back to the reservoir 73, or through check valve 80 and relief valve 78 to the reservoir, if the flow is in the opposite direction. Check valves 81 and 82 permit flow from the reservoir into the system in the event of a lack of pressure therein between the motor 44 and pump 72.

In FIGURES 12 and 12A, symbols CR1 to CR10, CRTD and CRLD designate relays of the type that hold closed contact only when current is supplied to the solenoid coil. Symbols CRT, CRR and CRD designate relays of the mechanical hold type that require only an electric pulse to un latch the contacts. The photoelectric relay contacts are shown for the receiver to light source beam not interrupted. In the lower left hand corner of FIGURE 12B, switches are shown for controlling manual operation of the machine 15. While these switches have not been described, legends have been utilized in connection therewith and in connection with other parts of this valve. Some of FIGURE 12B is shown in FIGURE 15 to afford a better understanding of the electric circuits employed. Various modifications and changes are contemplated and may be resorted to, without departing from the function or scope of the invention as hereinafter defined by the appended claims.

1. A machine for palletizing containers comprising a frame, a bin, means supporting said bin on said frame for rocking movement about a substantially horizontal axis, said bin having side walls, a rear wall and an open front, said bin for supporting a pallet in said bin and for adapting to support a pallet in said bin and for supporting the pallet and the containers mounted thereon in the tilted bin.

2. A machine as in claim 1, a pair of roller conveyors supported by said bottom and straddling said lift and adapted to support a pallet in said bin and during movement from the bin when said lift is in a fully retracted position, said top portion of the lift being disposed below the level of said roller conveyors in the fully retracted position of the lift.

3. A machine for palletizing containers comprising a bin having an open front, means supporting said bin for rocking movement about a substantially horizontal axis, means rocking said bin between an upright position and a tilted position with the open front of the bin inclined upwardly, and driven endless conveyor means supported by the upper portion of said bin including a lower flight movable along the underside of said top wall for controlling the movement of a tier of containers into said bin through its open front onto the pallet or onto a previously deposited tier of containers, said bin being disposed in a tilted position thereof during movement of the containers into the bin.

4. A machine as in claim 3, said means supporting the bin for rocking movement including a frame, said means for rocking the bin including a fluid pressure actuated cylinder connected to said frame and having a piston rod connected to a part of said bin.

5. A machine as in claim 3, said lift being of the scissors type including a stationary bottom frame secured to a part of the bin and a top section vertically movable within said bin and adapted to engage the pallet, levers disposed between the bottom frame and top section and pivotally connected intermediate of their ends in crossed relation to one another and having complementary ends pivotally connected to complementary ends of the bottom frame and top section, the opposite ends of said levers bearing against and having moving contact with said bottom frame and top section, a fluid pressure responsive means engaging portions of said levers for rocking the levers relative to one another when said fluid pressure responsive means is extended or retracted for raising or lowering said top section, respectively, relative to the bottom frame.

6. A machine as in claim 3, said means supporting the bin for rocking movement including a stationary frame, a palletizing frame connected to said stationary frame and disposed in front of the bin, a platform pivotally supported at one end thereof on said palletizing frame, extensible and retractable support means connected to the palletizing frame and said platform for supporting the platform in a substantially horizontal loading position or in a downwardly inclined discharging position, means mounted on said palletizing frame for loading the platform with containers to be palletized when the platform is in a loading position, and said extensible support means supporting the platform in an inclined discharging position substantially parallel to the plane of said lift in the tilted position of the bin and with the lower end of said platform extending into the open front of the bin for discharge of the containers by gravity into the upper portion of the bin.

7. A machine as in claim 6, pivotable stop means carried by the end of said platform disposed remote from the platform pivot for retaining the containers against movement off of said platform, and means on said bin engageable with said stop means for moving the stop means to a released position automatically when said platform end is swung downwardly into engagement with the bin for releasing the containers for gravity discharge from the platform.

8. A machine as in claim 7, said platform having a container supporting surface composed of rollers to facilitate movement of the containers onto the platform during loading of the platform and gravitational discharge of the containers from the inclined platform into the bin.

9. A machine as in claim 3, said means supporting the bin for rocking movement including a stationary frame, a palletizing frame connected to said stationary frame and disposed in front of the bin, a platform pivotally supported at one end thereof on said palletizing frame, extensible and retractable support means connected to the palletizing frame and said platform for supporting the platform in a substantially horizontal loading position or in a downwardly inclined discharging position, said palletizing frame having a substantially horizontal container supporting surface disposed beyond and adjacent the pivoted end of said platform, a transverse slide of the platform, and fluid pressure actuated pusher means disposed for reciprocating movement across said surface for moving containers transversely across the surface and onto the platform during movement of the pusher means in a direction toward the platform to effect loading of the platform with containers to be palletized when the platform is in a loading position, and said extensible
support means supporting the platform in an inclined discharging position substantially parallel to the plane of said lift in the tilted position of the bin and with the lower end of said platform extending into the open front of the bin for discharge of the containers by gravity into the upper portion of the bin.

10. A machine as in claim 9, a driven endless conveyor supported by the palletizing frame including a top flight constituting said horizontal container supporting surface, for conveying containers into a position in alignment with the platform and between said platform and said pusher means.

11. A machine as in claim 10, and an inclined chute having a lower discharge end disposed to discharge containers by gravity onto an end of said horizontal container supporting surface, said chute having a side wall provided with a laterally flared extension extending beyond the discharge end thereof and over a part of said horizontal container supporting surface, and driven conveyor means supported by the palletizing frame and connected to and driven by the endless conveyor thereof for engaging alternate containers discharged from said chute and for pushing said containers in the direction of movement of the top flight of said endless conveyor for cooperating with said flared wall portion for arranging the containers in two rows on said horizontal container supporting surface.

12. A machine as in claim 11, and means to effect alternate operation of said last mentioned endless conveyor and said pusher means automatically and only when said platform is in a raised substantially horizontal position.

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