

Nov. 25, 1952

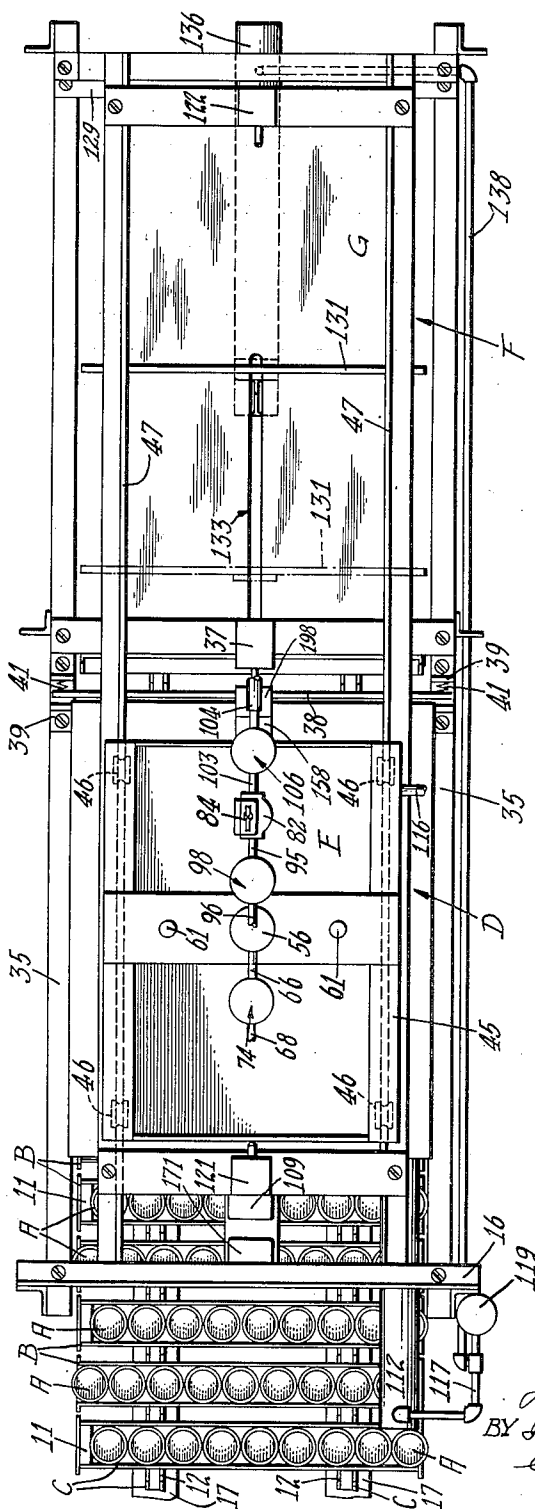
J. E. SOCKE
MACHINE FOR FEEDING, TRANSFERRING, AND
COMPACTING ARTICLES INTO A UNIT LAYER

2,619,237

Filed June 30, 1948

5 Sheets-Sheet 1

FIG 1



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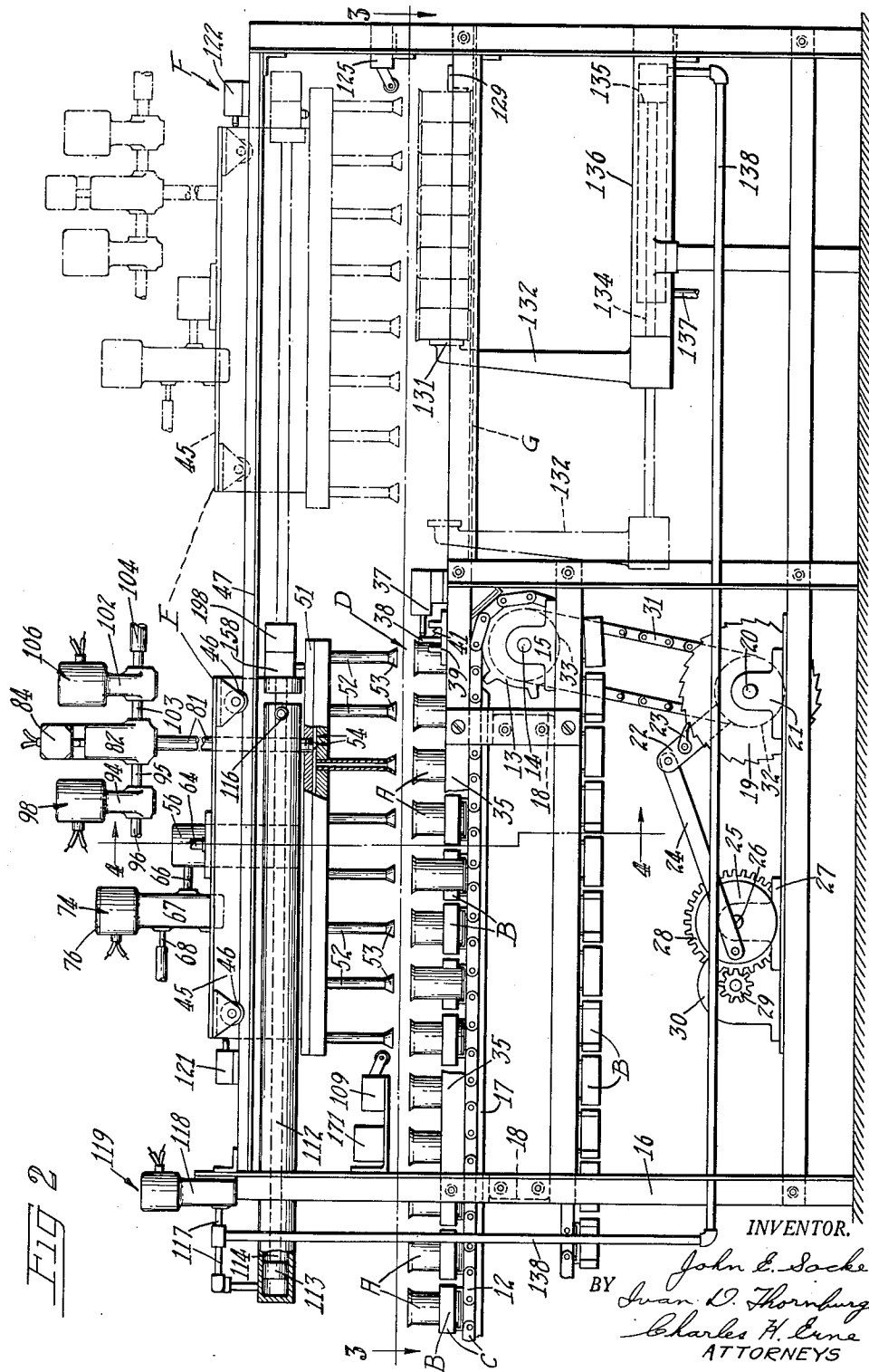
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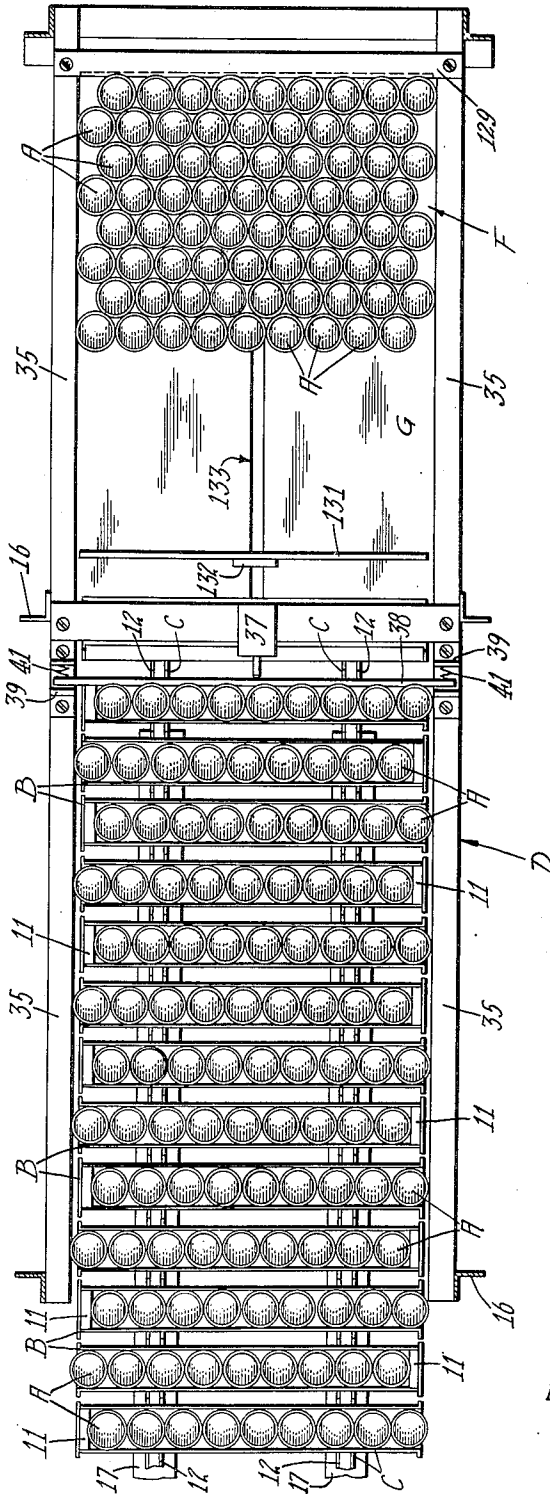
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5 Sheets-Sheet 3

FIG 3



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FIG 4

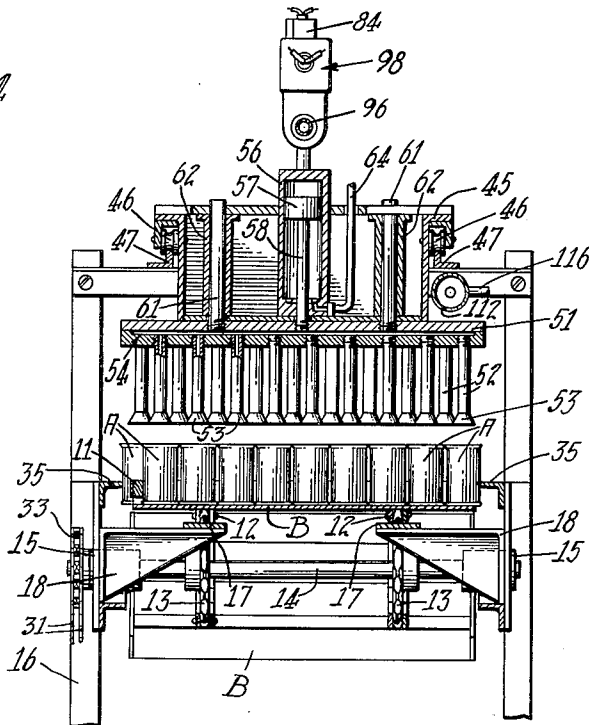


FIG 5

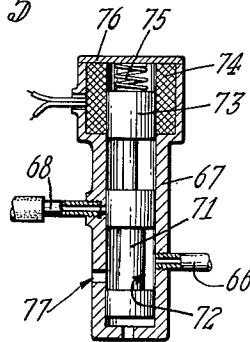
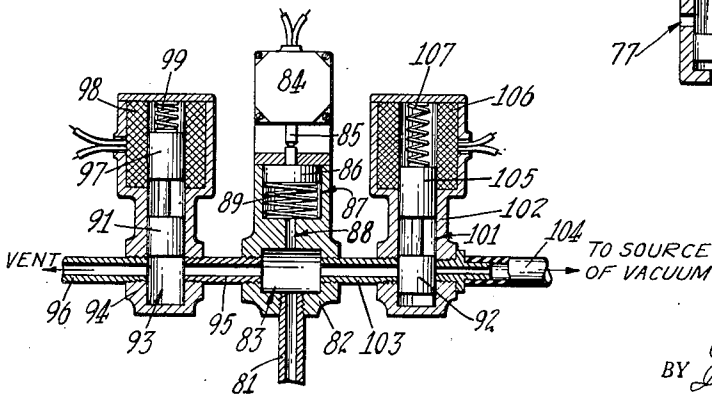


FIG 6



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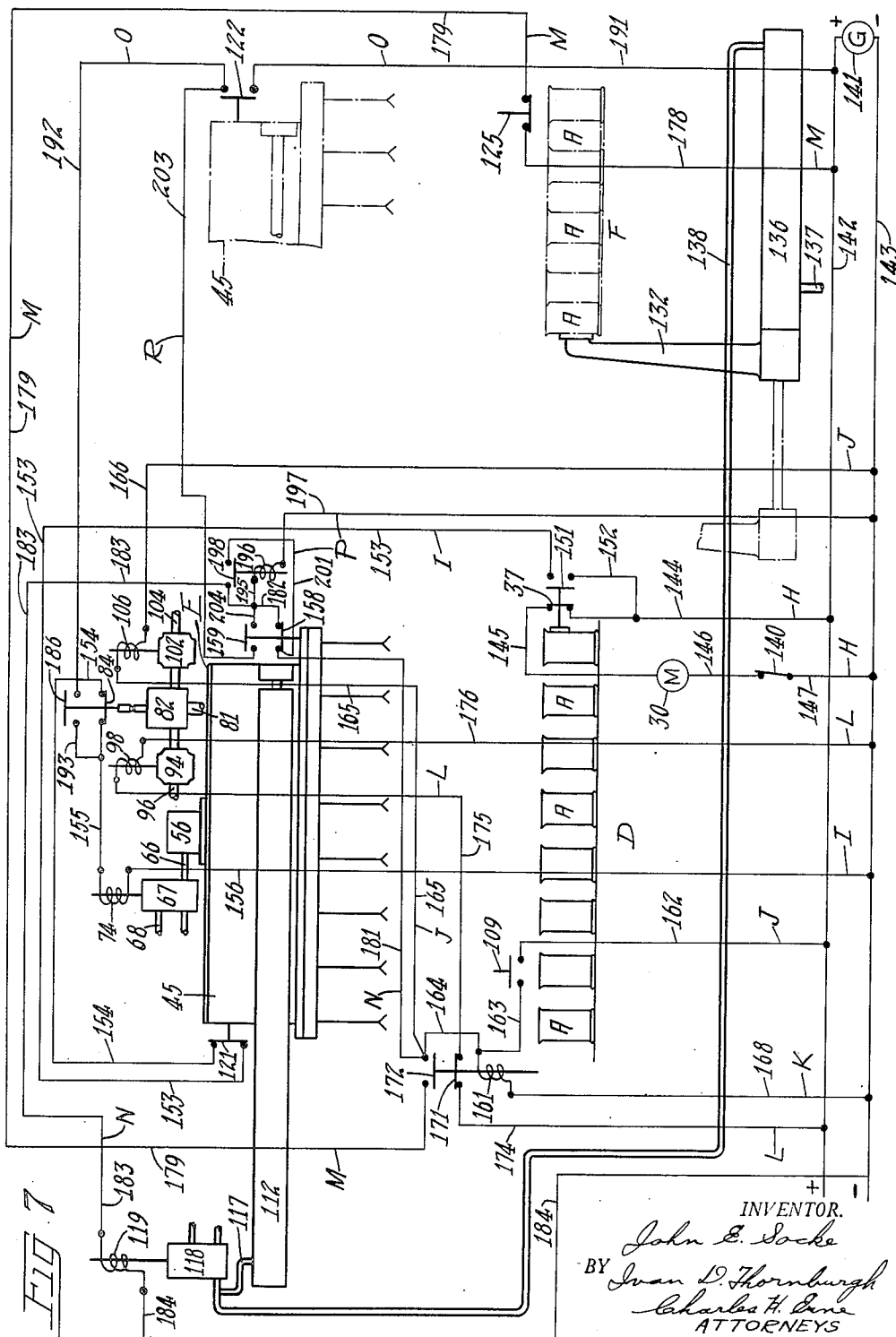
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UNITED STATES PATENT OFFICE

2,619,237

MACHINE FOR FEEDING, TRANSFERRING,
AND COMPACTING ARTICLES INTO A UNIT
LAYER

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Application June 30, 1948, Serial No. 36,175

6 Claims. (Cl. 214—1)

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The present invention relates to a machine for feeding containers or cans and other articles and has particular reference to devices for transferring a unit group of the articles from one part of the machine to another and for arranging the transferred group into a compact pattern for subsequent treatment as a unit. This is a companion application to my copending United States applications Serial Number 23,926, filed April 29, 1948, on Machine for Feeding and Positioning Containers in a Desired Pattern Arrangement, and Serial Number 36,177, filed June 30, 1948, on Control Mechanism for Article Transfer Device. Reference is also made to the joint application of John E. Socke and Lloyd H. Weber, Serial Number 36,176, filed June 30, 1948 on Bag Filling or Packing Machine, now Patent No. 2,524,846 issued October 10, 1950.

An object of the invention is the provision in a machine for feeding articles, of devices wherein articles received in spaced order are transferred as a unit group from one part of the machine to another and are arranged in a compact pattern of a predetermined form for subsequent treatment as a unit so as to expedite handling of the articles and to exercise control over them during handling.

Another object is the provision in such a machine of electrically and pneumatically operated vacuum transfer and compacting devices which operate through a predetermined cycle set into operation by the articles themselves when a predetermined group of such articles have been collected for transfer and for arrangement into a unit layer.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a top plan view of a machine embodying the present invention with parts broken away;

Fig. 2 is a side elevational view of the machine shown in Fig. 1, with parts broken away and with parts in section, the view showing in dotted lines parts of the machine in a different position;

Fig. 3 is a view similar to Fig. 1 taken substantially along the line 3—3 in Fig. 2;

Fig. 4 is a sectional view taken substantially along the broken line 4—4 in Fig. 2;

Figs. 5 and 6 are enlarged sectional views showing details of air and vacuum valves used in the machine; and

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Fig. 7 is a combined schematic view of the mechanical control parts of the machine and a wiring diagram of the electric equipment used in the machine.

As a preferred and exemplary embodiment of the instant invention the drawings illustrate a machine for receiving cans A in an upright position in spaced and parallel rows and in staggered relation and for arranging the received cans into a solid compact layer group for transfer as a layer unit from the machine to any suitable place of deposit for subsequent treatment.

In the machine, the individual rows of cans A (Figs. 1 and 2) are carried in pockets or troughs B of a conveyor C which advances the pockets intermittently (toward the right as viewed in Fig. 2) along a path of travel leading into a transfer station D. When a predetermined number of filled pockets B have entered the transfer station, the conveyor stops momentarily in a predetermined position so as to locate the pockets under a transfer device E which is movable vertically and horizontally from this station to a compacting station F located in advance of the transfer station.

As soon as the conveyor stops, the transfer device E moves down into engagement with the cans and lifts the entire batch bodily as a unit out of their pockets. When the cans are clear of their pockets the conveyor resumes operation to collect and advance another batch of cans. During the collection of this second batch of cans, the transfer device E with its picked up batch held in suspension, shifts horizontally to the right in Fig. 2 into the compacting station F. At this station the transfer device lowers the suspended batch of cans onto a table or platform G and then returns to the transfer station to pick up the next batch being formed on the conveyor.

While the transfer device E is returning to the transfer station D, the cans on the table G are pushed together into a compact arrangement to form a solid layer unit of cans in staggered relation and parallel rows. This completes the cycle of operation of the machine, the unit layer of cans being removed from the table G in any suitable manner for subsequent treatment.

The pockets or troughs B which carry the cans A preferably are rectangular in shape and are just wide enough to accommodate one row of cans extending transversely of the machine. The upper ends of the cans extend above the pockets. One end of these pockets is open to permit of the insertion of the cans into the pockets. The opposite or closed ends of the pockets are fitted

with spacer blocks 11 (Fig. 3) for staggering the cans in one pocket relative to the cans in an adjacent pocket. There are a plurality of these troughs or pockets B arranged in spaced and parallel order on the conveyor C and are secured to the conveyor to provide a continuous procession.

The conveyor C includes a pair of spaced and parallel endless chains 12 which extend from any suitable supply of the cans A to the transfer station D in the machine. The chains operate over a pair of sprockets 13 (Figs. 2 and 4) mounted on a cross shaft 14 located at the transfer station D and journaled in bearing brackets 15 secured in a frame 16 which constitutes the main frame of the machine. The frame preferably is made of vertically and horizontally disposed angle irons bolted together to provide a unitary structure. The upper runs of the chains are supported against sagging on a pair of longitudinal plate rails 17 which are supported on brackets 18 (Fig. 4) bolted to the machine frame.

Intermittent advancement of the conveyor C for carrying the can filled pockets B into the transfer station D is effected by a ratchet device (Fig. 2) which is located below the conveyor and which includes a ratchet wheel 19 mounted on a horizontal shaft 20 journaled in bearing brackets 21 secured to the machine frame 16. The ratchet wheel and its shaft are rotated intermittently by an arm 22 which carries a pawl 23 engaging against the teeth on the ratchet wheel. One end of the arm is freely mounted on the wheel shaft 20 (Fig. 2). The opposite end of the arm is pivotally connected to a link 24 which is attached to and is actuated by a crank disc 25 carried on a shaft 26 journaled in a bearing bracket 27 secured to the machine frame 16. The shaft 26 is rotated by a gear 28 which is mounted on the shaft 26 and which meshes with and is driven by a pinion 29 of an electric motor 30. The intermittent rotation of the ratchet wheel 19 is transmitted to the conveyor C by an endless chain 31 which operates over a sprocket 32 carried on the wheel shaft 20 and over a sprocket 33 mounted on the conveyor shaft 14.

Hence when the electric motor 30 is in operation it reciprocates the ratchet arm 22 and this intermittently rotates the ratchet wheel 19, its shaft 20, and the conveyor C connected thereto. This intermittent advancement of the conveyor primarily is for the purpose of providing rest periods during which the cans A are loaded into the pockets B. This loading operation is effected prior to the entrance of the cans into the instant machine and forms no part of this invention. As the can filled pockets B enter the machine, the cans are restrained against displacement from the open ends of the pockets by guide rails 35 (Fig. 2) which are secured to the machine frame 16.

Stopping and restarting of the conveyor C as hereinbefore mentioned is effected by the cans A through the actuation of a normally closed electric control switch 37 located at the transfer station D. The switch 37 is connected to the electric motor 30 through a suitable electric circuit which will be more fully described hereinafter in connection with the wiring diagram shown in Fig. 7.

The movable element of the switch 37 engages against a horizontally disposed and floating actuating bar 38 (Figs. 1, 2 and 3) which extends transversely of the machine at the transfer station D, and is located at a level just above the

path of travel of the conveyor pockets B but in line with that portion of the cans which extend above the pockets.

The outer ends of the bar are freely supported in retaining blocks 39 secured to the machine frame 16. These blocks carry compression springs 41 which yieldably press the bar in a direction toward the incoming cans and away from the switch 37 so that the switch normally remains closed.

Hence when a predetermined number of conveyor pockets B carrying rows of cans A have entered the transfer station D, the leading row of cans in the procession engages the actuating bar 38 and pushes it against the electric switch 37. This immediately opens the switch and breaks the circuit connecting with the motor 30. The motor thus stops operating. It is this action that stops the conveyor C in a predetermined position in the transfer station so as to locate a predetermined number of the can filled pockets B under the transfer device E as hereinbefore mentioned.

The conveyor C remains stationary until the spaced rows of cans in the pockets B have been removed. Removal of the cans releases the actuating bar 38 and thus permits its compression springs 41 to shift the bar away from the switch 37. This closes the switch 37 and re-establishes the circuit connecting with the motor 30. The motor thereupon resumes operation and continues its intermittent advancement of the conveyor C to move the empty pockets B out of the transfer station D and to move another set of can filled pockets B into place under the transfer device E at the transfer station.

The transfer device E which removes the cans A out of the conveyor pockets B comprises a horizontally disposed, rectangular shaped carriage 45 (Figs. 1, 2 and 4) mounted on four rollers 46 which ride on a pair of spaced and parallel tracks 47 secured to the machine frame 16. These tracks are disposed above the path of travel of the conveyor C and extend longitudinally of the machine for its entire length, thereby traversing the transfer station D and the compacting station F.

The carriage 45 carries a lifter pad 51 (Figs. 2 and 4) which comprises a pair of flat horizontally disposed upper and lower rectangular plates secured together as a unitary structure and which are movable toward and away from the conveyor C. The lower plate carries a plurality of depending vacuum tubes 52 terminating in vacuum cups 53 and arranged in spaced and parallel rows in accordance with the number and positions of the cans in the conveyor pockets B at rest at the transfer station D. There is one vacuum tube for each can. The upper ends of the tubes communicate with interconnected vacuum channels or grooves 54 formed in the top surface of the lower plate of the lifter pad 51.

The lifter pad 51 normally is retained in a suspended position on the carriage 45 and periodically is moved toward and away from the conveyor C by compressed air devices which include a vertical closed cylinder 56 (Fig. 4) supported on and movable with the carriage. The cylinder contains a piston 57 mounted on a piston rod 58 which extends down through the cylinder and is secured in the upper plate of the lifter pad 51. Pilot or guide pins 61 secured in the upper plate of the lifter pad extend up through sleeves 62 secured on the carriage 45 and guide the lifter pad against turning during its vertical travel.

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Compressed air is continuously introduced into the cylinder 56 adjacent its lower end by an inlet pipe 64 (Fig. 4) which leads from any suitable source of air under pressure. This air exerts its force against the lower face of the piston 57 and thus holds the pad in its uppermost position as shown in Fig. 4.

Actuation of the lifter pad is effected by compressed air which is introduced into the cylinder 56 at its upper end above the piston 57, through a pipe 66 (Figs. 2 and 5) which is connected into the cylinder and into a lifter valve housing 67. This valve housing is connected by a pipe 68 to the source of air under pressure. The pipe 68 is spaced above the pipe 66 as shown in Fig. 5. The flow of air through the valve housing is controlled by a slide valve 71 disposed within the housing and formed with an annular by-pass groove 72. This valve is connected to a core 73 of a normally de-energized electric solenoid 74 mounted in the valve housing 67. A compression spring 75 interposed between the end of the core 73 and a cover plate 76 of the solenoid retains the valve 71 in its normal position as shown in Fig. 5. In this normal position the valve cuts off the supply of air from the supply pipe 68 and maintains its groove 72 in communication with the inlet pipe 66 and with a vent port 77 formed in the valve housing 67 just below the pipe 66.

The position of the slide valve 71 changes when the conveyor C stops as hereinbefore mentioned. As soon as the conveyor stops, the electric solenoid 74 is immediately energized through electric circuits which will be hereinafter explained in connection with the wiring diagram in Fig. 7. This energizing of the solenoid lifts its core 73 and the valve 71 connected therewith and thus closes the vent port 77 and opens the supply pipe 68 to communication with the inlet pipe 66. Hence compressed air from the pipe 68 passes through the valve by-pass groove 72, and pipe 66 into the cylinder 56 and exerts its force against the upper face of the piston. Since this upper face is greater in area than the lower face by an amount equal to the area of the piston rod, the air above the piston pushes the piston down in its cylinder. This action lowers the lifter pad 51 and thus moves the vacuum cups 53 down onto the cans A in the conveyor pockets B.

In the instant case, empty cans A are shown in the drawings by way of example of the articles to be transferred and arranged in a unit layer, although the invention is equally well adapted to filled and sealed cans or to other articles. In the case of empty cans, the vacuum cups move down into the cans and engage against their bottoms at the bottom of the stroke of the lifter pad 51.

As soon as the lifter pad 51 reaches the bottom of its stroke, the slide valve 71 is shifted back into its normal position by a de-energizing of the solenoid 74. This cuts off the flow of compressed air from the supply pipe 68 into the cylinder 56 and opens the vent port 77. This permits the air from the inlet pipe 64 at the bottom of the cylinder to lift the piston 57 and thus return the lifter pad 51 to its normal raised position as shown in Fig. 4.

Simultaneously with this shifting of the valve 71 into its normal position to return the lifter pad 51, a vacuum is drawn on the vacuum cups 53 for the purpose of gripping the cans A and lifting them bodily with the lifter pad to remove them from the conveyor pockets B and to temporarily hold them in suspension above the con-

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veyor as hereinbefore mentioned. This vacuumizing of the vacuum cups 53 is brought about by a cup venting and vacuumizing mechanism supported on a vertically disposed combination vent and vacuum tube 81 (Figs. 2 and 6) projecting up from and movable with the lifter pad 51. The lower end of the tube is threadedly secured in the upper plate of the lifter pad and communicates with the interconnected vacuum channels 54 in the lower plate.

The upper end of the vent-vacuum tube 81 supports a switch housing 82 and is in communication with a chamber 83 enclosed by the housing. The upper portion of the housing carries a normally closed electric switch 84 having an actuating element 85 which rests upon the upper end of a stem of a piston 86 located in a short cylinder 87 formed in the housing 82. The lower end of the cylinder is connected by a channel 88 with the chamber 83. A compression spring 89 interposed between the piston and the bottom of the cylinder normally maintains the switch 84 in a closed condition.

Cooperating with the vacuum switch 84 is a normally open solenoid controlled vent valve 91 (Fig. 6) and a normally closed solenoid controlled vacuum valve 92. The vent valve 91 is disposed in a bore 93 of a valve casing 94 connected by and supported on a short pipe 95 secured in the switch housing 82. The interior of the pipe 95 is in communication with the bore 93 in the valve casing and the chamber 83 in the switch housing. Opposite the pipe 95, the valve bore 93 communicates with a short vent tube 96 which is secured in the valve casing and which is open to the atmosphere. Within the valve bore 93 the valve 91 is connected to a core 97 of a normally energized electric solenoid 98 enclosed in the valve casing. The core is maintained under pressure of a compression spring 99 interposed between the upper end of the core and the top of the valve casing. The normally energized solenoid keeps the valve 91 in a raised position as shown in Fig. 6 and thus normally admits the outside air through the vent tube 96 into the switch chamber 83 and vent-vacuum tube 81 and channels 54 leading to the vacuum cups 53.

The vacuum valve 92 is located in a bore 101 of a valve casing 102 supported on a short pipe 103 which communicates with the valve bore 101 and with the chamber 83 of the switch housing 82. Opposite the pipe 103 the valve casing 102 is connected to a vacuum pipe 104 which communicates with the valve bore 101. This vacuum pipe 104 leads to any suitable source of vacuum. Communication between the vacuum pipe 104 and the pipe 103 is normally cut off by the vacuum valve 92 in the valve bore 101. This valve 92 is connected to a core 105 of a normally de-energized electric solenoid 106 enclosed in the valve casing 102. The core is maintained under pressure of a compression spring 107 interposed between the upper end of the core and the top of the valve casing.

The operation of this venting and vacuumizing mechanism is as follows. When the lifter pad 51 moves down toward the cans A in their conveyor pockets B and reaches the bottom of its stroke with the vacuum cups 53 engaging the bottoms of the cans, the lifter pad engages and operates an electric switch 109 (Fig. 2) in the circuits to be hereinafter explained in connection with the wiring diagram and the operation of this switch immediately deenergizes the vent

solenoid 98 and simultaneously energizes the vacuum solenoid 106 of the venting and vacuumizing mechanism. The vent valve 91 thereupon closes and cuts off the chamber 83 from communication with the atmosphere. At the same time, the vacuum valve 92 opens and establishes communication between the chamber 83 and the vacuum pipe 104.

Thus the vacuum cups 53, by way of the channels 54 in the lifter pad 51 and the vent-vacuum tube 81 connecting with these channels and the chamber 83, are subjected to the vacuum pull in the vacuum pipe 104 and are thus vacuumized, with the result that they grip and hold the cans A. When sufficient vacuum is created in these connecting parts to grip and hold the cans, the piston 86 is drawn down into its cylinder 87 against the force of its spring 89 and this permits the normally closed switch 84 to open. It is the opening of this switch 84 that starts the lifter pad 51 through its return, upward stroke to lift the cans A out of their conveyor pockets B, the switch 84 being connected for this purpose to the solenoid 74 (Fig. 5) of the lifter pad actuating valve as will be hereinafter explained in connection with the wiring diagram.

When the lifter pad 51 reaches the top of its return stroke and is in its normal raised position, the transfer carriage 45 is shifted along its rails 47 to the right of Fig. 2 from the transfer station D into the compacting station F and thus carries the suspended cans into a position directly above the compacting table G. During this movement of the cans, the vacuum is maintained on the vacuumizing cups 53 to hold them in suspended position.

Movement of the transfer carriage 45 is effected preferably by compressed air which is introduced into a long horizontal closed cylinder 112 (Figs. 1, 2 and 4) disposed adjacent the path of travel of the carriage and secured to the machine frame 16. This cylinder contains a piston 113 (Fig. 2) which is connected to a long piston rod 114, the opposite end of which is bolted to the carriage 45. In this cylinder, like the lifter pad cylinder 55, compressed air from any suitable source of supply is continuously introduced into the piston rod end of the cylinder by way of a pipe 116 (Fig. 2) to normally maintain the carriage in a predetermined position at the transfer station D. The opposite end of the cylinder receives compressed air from the same source of supply by way of a pipe 117 (Fig. 2) which connects with a control valve enclosed within a valve housing 118 and actuated by a normally de-energized electric solenoid 119 similar to the valve 71 (Fig. 5) and solenoid 74. The solenoid 119 is controlled by electric switches 121, 122 (Fig. 2) secured to the machine frame 16 and engageable by the carriage 45 as it shifts from one station to the other. These switches are in the circuits to be hereinafter explained.

Hence when the solenoid 119 is energized it raises the valve within the valve housing 118 and permits compressed air to enter the outer end of the cylinder, in front of the piston 113 and thus forces the piston toward the right as viewed in Fig. 2. The movement of the piston shifts the carriage 45 into the compacting station F as hereinbefore mentioned.

When the carriage 45 comes to rest at the compacting station F, the lifter pad 51 and the cans A held in suspension thereon, are moved down to deposit the cans on the table G between the two side guide rails 35 (Figs. 1, 2, 3 and 4).

This is effected by a reenergizing of the lifter pad solenoid 74 (Fig. 5) of the valve 71. The re-energizing of the solenoid raises the valve 71 in its housing 67 to a position which admits compressed air from the supply pipe 68 into the upper end of the lifter pad actuating cylinder 56 and this air forces the piston 57 and the lifter pad 51 downwardly toward the table G.

When the cans A are fully seated on the table G, the vacuum maintained within the vacuum cups 53 is dissipated and this releases the cans from the cups. This breaking of the vacuum is effected by the opening of a normally closed electric switch 125 (Fig. 2) which is engaged by the lifter pad 51 as it approaches the bottom of its downward stroke. The switch is connected to the solenoids 93, 106 (Fig. 6) of the venting and vacuumizing mechanism hereinbefore mentioned. When this switch is opened, the de-energized solenoid 93 becomes energized and this opens the vent valve 91 and permits air at atmospheric pressure to enter the mechanism and thus break the vacuum. Simultaneously with this action, the energized solenoid 106 becomes de-energized and this closes the vacuum valve 105 and thus cuts off the mechanism from the source of vacuum.

With the cans A thus in position on the table G and released from the vacuum cups 53, the lifter pad 51 moves up into its normal position against the carriage 45 as best shown in dotted lines in Fig. 2. This is brought about by a de-energizing of the lifter pad solenoid 74 (Fig. 5) and a resulting closing of the lifter valve 71 so that compressed air from the supply pipe 68 is cut off and the air operating against the rod side of the piston 57 (Fig. 4) is permitted to raise the piston and the lifter pad connected therewith.

As soon as the lifter pad 51 returns to its normal elevated position, the carriage 45 returns to its normal position at the transfer station D as shown in full lines in Fig. 2, in readiness for a repeat cycle of operations on the next batch of cans now being collected on the conveyor C. This return movement of the carriage 45 is effected by a de-energizing of the energized solenoid 119 (Fig. 2) of the actuating cylinder 112. De-energizing of the solenoid shifts the valve in the valve housing 118 and cut off the supply of compressed air entering the outer end of the cylinder and vents this end of the cylinder to the atmosphere. This permits the constant air pressure on the inner end of the cylinder through pipe 116, to force the piston 113 and the carriage 45 connected therewith, toward the left as viewed in Fig. 2, and this returns the carriage to the transfer station D.

During this return movement of the carriage 45 the cans A deposited on the table G in staggered relation and spaced parallel rows as they were on the conveyor C (at the left in Fig. 3), are moved together or compacted into a compact arrangement or unit layer in which all of the cans touch each other while maintaining their staggered and their parallel row relation as shown at the right in Fig. 3, the cans being pressed against a transverse stop rail 120, the ends of which are secured to the main frame 16. The side guide rails 35 prevent lateral displacement of the cans during this action.

Compacting of the cans is brought about preferably by a pusher member, preferably a plate or bar 131 (Figs. 1, 2 and 3) which extends transversely of the machine at the compacting station F at a level even with the sides of the cans for

engagement therewith. This pusher member or bar 131 is carried on the upper end of a vertically disposed and longitudinally reciprocable arm 132 (Fig. 2) which operates in a longitudinal slot 133 (Figs. 1 and 3) formed in the table G. The lower end of the arm is mounted on a piston rod 134 (Fig. 2) carrying a piston 135 which operates in a cylinder 136 secured to the machine frame 16 below the table G.

In its normal position, the compacting arm 132 engages against the inner or piston rod end of the cylinder 136 as best shown in Fig. 2, the cylinder serving as a stop for locating the arm. The arm is held in this position by compressed air which acts against the adjacent face of the piston 135 and which is introduced into the rod end of the cylinder through a supply pipe 137 which leads from any suitable source of air under pressure. The opposite or outer end of the cylinder 136 is connected by a pipe 138 to the pipe 117 (Fig. 2) through which compressed air controlled by the valve in the housing 118 passes into the carriage cylinder 112.

Hence when the valve in the valve housing 118 opens to admit air into the carriage cylinder 112 to push the carriage 45 from the transfer station D into the compacting station F, it also introduces compressed air through pipe 138 into the outer end of the compacting cylinder 136. This air in the compacting cylinder 136 acts against the large area outer face of the piston 135 and pushes the piston and the arm 132 connected therewith toward the left as viewed in Fig. 2 and shown in dotted lines. The arm remains in this shifted position while the cans A are deposited on the table G as hereinbefore mentioned. When the valve in the housing 118 is closed by solenoid 119 to cut off the air from the carriage cylinder 112 to allow the carriage 45 to return to the transfer station D, it also cuts off the flow of air into the outer end of the compacting cylinder 136 and vents the cylinder and this permits the continuous-pressure air coming through the pipe 137 at the opposite end of the cylinder to return the compacting arm 132 to its normal position in engagement with the cylinder as shown in full lines in Fig. 2. During this return travel of the arm 132, its compacting bar 131 engages the cans A on the table G and pushes them toward the right against the stop rail 129 (as viewed in Fig. 2), thus moving them together into a compact unit layer arrangement as hereinbefore explained for discharge from the machine. This discharge may be effected in any suitable manner, the mode of discharge forming no part of the instant invention and is not shown in the drawings. This completes the cycle of operation of the machine.

Reference should now be had to the wiring diagram in Fig. 7 which schematically shows electric equipment for controlling and operating the various solenoids and switches hereinbefore mentioned. The cycle of operation of the machine is started through a starting circuit H which includes the electric motor 30, the normally closed conveyor stopping and restarting switch 37 and a service switch 140. This circuit like all the other circuits to be described transmits electric current from a generator 141 having a main or generator lead wire 142 and a return lead wire 143.

In the starting circuit H one side of the closed switch 37 is connected by a wire 144 to the main lead wire 142. The other side of the switch is connected by a wire 145 to the motor 30. The motor is also connected by a wire 146 to one side

of the service switch 140. The opposite side of this switch is connected by a wire 147 to the return lead wire 143.

Hence when the service switch 140 is closed, electric current from the generator 141 flows along the circuit H and this starts the motor 30. The service switch 140 is closed only to start the machine and remains closed until it is desired to stop the machine. Hence during a cycle of operation of the machine, the motor 30 continues to operate as long as the switch 37 remains closed. It is during this period of the cycle of operation that the cans A are loaded into the conveyor pockets B and are advanced by the conveyor into the transfer station D.

When the transfer station D is filled with rows of cans A in their conveyor pockets B, the leading row of cans opens the switch 37 and this breaks the circuit and temporarily stops the motor 30 as hereinbefore explained. Opening of the switch 37 simultaneously closes a cooperating normally open switch 151 which is formed as a part of the switch 37 and which constitutes an element of a lifter pad lowering circuit I. This circuit I includes the normally closed carriage switch 121, the normally closed vacuum switch 84, and the lifter valve solenoid 74. Electric current from the generator 141 passing along this circuit I travels from the main lead wire 142, along 144 of the starting circuit H, along a connecting wire 152, closed switch 151, a connecting wire 153, closed carriage switch 121, a connecting wire 154, closed vacuum switch 84, a connecting wire 155, the lifter valve solenoid 74, returning along a connecting wire 156 to the return lead wire 143.

Electric current passing along the circuit I energizes the lifter valve solenoid 74 and thus opens the valve to permit compressed air to flow into the lifter cylinder 56 and thus lower the lifter pad 51 and its vacuum cups 53 into engagement with the cans in the conveyor pockets B as hereinbefore explained. As soon as the lifter pad 51 starts to move down it opens a normally closed control switch 158 and closes an integrally formed normally open control switch 159 having a common switch element which engages against the upper surface of the lifter pad. However the actuation of these switches performs no function at this time, their effect on the various circuits being reserved for a later period in the cycle of operation.

When the descending lifter pad 51 reaches the bottom of its stroke and engages the cans A, it also engages and closes the normally open switch 109. Closing of this switch does two things. It establishes a vacuumizing circuit J which includes the normally de-energizing vacuumizing valve solenoid 106 of the vent-vacuum mechanism and also closes a relay circuit K which includes a normally de-energized relay solenoid 161. In the vacuumizing circuit J electric current passes from the generator lead wire 142 along a wire 162, through the closed switch 109, along wires 163, 164, 165 to and through the vacuumizing valve solenoid 106 and returns along a wire 166 to the return lead wire 143. This current energizes the vacuum valve solenoid 106 and thus opens the vacuumizing valve 105 (Fig. 6) to vacuumize the cups 53 in engagement with the cans A.

Current passing along this vacuumizing circuit J also passes along the relay circuit K, the current passing from the wire 163 through the relay solenoid 161 and returns along a connecting wire 168 to the return lead wire 143. Current passing along this circuit K energizes the relay solenoid 161.

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noid 161 and thereby opens a normally closed relay switch 171 included in a vent circuit L and also closes a normally open relay switch 172 included in a vacuum holding circuit M.

In the vent circuit L, electric current from the generator lead wire 142 normally passes along a wire 174, through the closed relay switch 171, along a connecting wire 175 to and through the normally energized venting valve solenoid 98 of the vent-vacuum mechanism and returns along a wire 176 to the return lead wire 143. When the relay switch 171 opens, it breaks this circuit L and thereby de-energizes the venting valve solenoid 98. This closes the vent valve 91 (Fig. 6) as hereinbefore explained to cut off the outside atmosphere so that the vacuum cups 53 can be vacuumized.

Since the vacuum pull on the cups 53 and their engaged cans A is maintained while the lifter pad 51 lifts the cans off the conveyor C and transfers them to the table G at the compacting station F, provision is made for holding the relay solenoid 161 energized when the lifter pad 51 rises and thereby releases and opens the switch 109. It is for this purpose that the vacuum holding circuit M is established by the closing of the relay switch 172. When this switch is closed electric current from the generator lead wire 142 passes along a wire 178 (at the right in Fig. 7) adjacent the compacting station F through the normally closed switch 125, along a wire 179, through the closed relay switch 172, along wire 164, through the energized relay solenoid 161, returning along wire 168 of the circuit K to the return lead wire 143. This current maintains the relay solenoid 161 in its energized condition.

When a predetermined amount of vacuum is created in the vacuum lines connecting with the vacuum cups 53 to insure lifting of the cans with the lifter pad 51, the normally closed switch 84 of the vent-vacuum mechanism, opens and thereby breaks the lifter pad lowering circuit I. The breaking of this circuit opens the air valve 71 (Fig. 5) of the lifter pad mechanism and this raises the lifter pad 51 and the cans A attached thereto. As the cans rise from the conveyor C they release the starting switch 37 of the starting circuit H. The switch 37 thereupon closes and re-establishes the starting circuit H so that the motor 30 again operates to advance the conveyor C for the collection of a new batch of cans A at the transfer station. Simultaneously with the closing of the switch 37 its associated switch 151 opens and thus insures against re-establishment of the lifter pad lowering circuit I due to failure of the vacuum with a consequent early closing of the vacuum switch 84.

When the lifter pad 51 reaches the top of its stroke, holding the cans A in suspension, it engages and closes the control switch 158 and opens its cooperating control switch 159. Closing of the switch 158 establishes a circuit N which is an extension of the circuit M and which is utilized for the purpose of shifting the transfer carriage 45 into the compacting station F and for simultaneously shifting the compacting arm 132 in readiness to receive the cans A on the table G. The circuit N includes the normally de-energized solenoid 119 of the air valve 118 which admits air into the cylinder 112 for actuating the carriage.

Tracing the flow of current through the combined circuits M and N, the current passes from the generator lead wire 142 along the wire 178 (at the right in the diagram), through the closed

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switch 125, along wire 179, through closed relay switch 172, along a wire 181 of circuit N, through the closed switch 158, along a wire 182 and a connecting wire 183 to and through the carriage solenoid 119 returning along a wire 184 to the return lead wire 143. Current passing along this circuit energizes the solenoid 119 and thus opens the air valve in the housing 118 and effects the shifting of the carriage 45 into the compacting station F. The switches 158, 159 move with the carriage.

As the carriage 45 begins its shifting movement it moves away from the switch 121 at the left of the carriage and this opens the switch and insures against re-energizing the lifter pad solenoid 74 during movement of the carriage. When the carriage reaches the compacting station F and is in proper position it engages and closes the normally open switch 122.

The closing of the switch 122 establishes a circuit O which includes the lifter solenoid 74 and a normally open switch 186 formed as a part of the vacuum switch 84 of the vent-vacuum mechanism. The switch 186 closes when the switch 84 opens, these switches remaining in these conditions as long as sufficient vacuum is maintained to hold the cans A against the vacuum cups 53. The circuit O is utilized to re-energize the lifter solenoid 74 to open the air valve 71 (Fig. 5) and thus lower the lifter pad 51 and the cans A toward the table G at the compacting station F. For this re-energizing operation electric current from the generator lead wire 142 passes along a wire 191 (extreme right in the diagram), through the closed switch 122, a wire 192, through the closed switch 186, along a wire 193 and the wire 155 to and through the solenoid 74, returning along wire 156 to the return lead wire 143. Current passing along this circuit energizes the solenoid 74.

In order to prevent breaking of the circuit N so as to hold the carriage solenoid 119 energized to maintain the carriage 45 in its position at the compacting station F when the lifter pad 51 moves down away from the switch 158 and opens it, a relay holding circuit P is provided which by-passes the control switch 158. This circuit takes electric current from the wire 182 of circuit N, the current passing along a connecting wire 195, through a relay solenoid 196, returning along a wire 197 to the return lead wire 143. Current passing along this circuit energizes the relay solenoid 196 and thereby closes a normally open relay switch 198 actuated by the solenoid.

The closing of the relay switch 198 establishes the by-pass portion of the circuit P and provides for the continued energization of the carriage solenoid 119 during the interval when the switch 158 is opening and the switch 159 is closing, during which interval both switches are open. In this by-pass portion of the circuit P, current from the wire 181 of circuit N at switch 158 passes around the switch along a wire 201, through the closed relay switch 198, wire 183, carriage solenoid 119 and wire 184 to the return lead wire 143. Current also passes from the closed relay switch 198 along the wire 182 to and through the relay solenoid 196 and wire 197 to the return lead wire 143 to maintain the relay solenoid 196 energized and the relay switch 198 closed.

When the lifter pad 51 descends far enough to close the switch 159 a new holding circuit R is formed which includes this switch and which cuts out the relay solenoid 198 for the purpose of subsequently breaking the carriage circuit N.

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Current for this circuit R is received from the circuit O, the current passing from the generator lead wire 142 along the wire 191 and through the closed switch 122 of circuit O, then along a wire 203 of circuit R, through the closed switch 159, along a wire 204 and wires 182, 183 to and through the carriage solenoid 119 and along wire 184 to the return lead wire 143.

When the lifter pad 51 reaches the bottom of its down stroke and deposits the cans A on the table G at the compacting station F, the vacuum in the vacuum cups 53 is broken to release the cans from the lifter pad and to leave them on the table. This is effected by the pad at the bottom of its stroke engaging against and opening the switch 125 in circuit M. This breaks the circuit M and that portion of circuit K which includes the relay solenoid 161. The solenoid 161 thereupon becomes de-energized and this returns the relay switch 171 to its normally closed condition and simultaneously returns the relay switch 172 to its normally open condition.

Opening of the relay switch 172 breaks that portion of circuit N which leads into the by-pass portion of circuit P and thus de-energizes the relay solenoid 196 and opens the relay switch 198 in circuit P. Thus the sole current supply for the carriage solenoid 119 is now through switch 159 of circuit R. The opening of the relay switch 172 also breaks the circuit J and this de-energizes the vacuum solenoid 106 and closes the vacuum valve 105 (Fig. 6). This cuts off the source of vacuum.

The simultaneous closing of the relay switch 171, re-establishes the broken venting circuit L including the venting solenoid 98 and this re-energizes the solenoid and opens the venting valve 91 (Fig. 6). The vacuum system, including the vacuum cups 53, is thereupon vented to the outside atmosphere and the vacuum is broken. The cans A are thus released from the cups and are supported solely by the table G. This dissipation of the vacuum in the cups 53 also returns the vacuum switch 84 in circuit I to its normally closed condition and returns the connected vacuum switch 186 in circuit O to its normally open condition.

The closing of the vacuum switch 84 accomplishes nothing at this time except to partially re-establish circuit I for the return of the carriage 45 to its normal position at the transfer station D, since switch 121 in this circuit I is still open. However, the opening of the vacuum switch 186 in circuit O immediately breaks this circuit and thereby de-energizes the solenoid 74 in the circuit I portion. De-energizing of this solenoid 74 closes the air valve 71 (Fig. 5) and vents the lifter pad cylinder 56 and thus permits the lifter pad 51 to move upwardly away from the table G, leaving the cans on the table.

When the rising lifter pad 51 reaches the top of its stroke, against the carriage 45, it engages and returns the control switch 158 to its normally closed condition and simultaneously returns the control switch 159 to its normally open condition. Closing of the switch 158 partially re-establishes the circuit N for the next cycle of operation. However, the opening of the switch 159 breaks the circuit R and that portion of circuit N that includes the carriage solenoid 119 and thus de-energizes the solenoid 119. De-energizing of this solenoid closes the air valve within the valve housing 118 and thus cuts off the supply of air to the carriage cylinder 112 and the compacting cylinder 136 and vents these cylinders

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This permits the carriage 45 to return to its normal position at the transfer station D where it engages and closes the open control switch 121 for the next cycle of operation. It also permits the compacting arm 132 to return to its normal position to effect the compacting of the cans A on the table G into the desired unit layer of cans as hereinbefore explained. This completes the cycle of operation of the electric circuits and devices used in the machine.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a machine for feeding spaced rows of containers and for arranging them in a pattern formation, the combination of an intermittently operated conveyor for feeding said rows of containers, a platform located adjacent said conveyor, a lifting device movable relative to and between said conveyor and platform for lifting the articles as a unit layer from the conveyor and for depositing them onto said platform, a plurality of suction cups carried on said lifting device and connecting with a vacuum line leading to a source of vacuum for gripping and holding the containers during movement of said lifting device, an air operated cylinder for raising and lowering said lifting device, an electric control valve for effecting the operation of said air cylinder, electric means connecting with said valve and operable by the vacuum in said vacuum line for delaying the lifting action of said lifter device until a sufficient supply of vacuum is connected to said suction cups to insure the gripping and lifting of the containers, a movable element operable adjacent said platform for engaging and shifting the deposited containers on said platform into a desired compact pattern formation, and fluid pressure means actuated by said lifting device for moving said movable element into engagement with said deposited containers for the purpose described.

2. In a machine for feeding articles and for arranging them in a staggered pattern formation, the combination of an endless conveyor, a plurality of parallel elongated pockets carried on said conveyor transversely of its path of travel for feeding spaced rows of articles with a row in each pocket, means in said pockets for engaging alternate ends of the rows for locating the articles in a pocket in staggered relation to the articles in an adjacent pocket, a platform located adjacent said conveyor, lifting means movable relative to said conveyor and to said platform, said lifting means having article engaging devices disposed in staggered relation corresponding to the staggered rows of articles in the said conveyor pockets for removing a plurality of rows as a unit layer and for depositing them onto said platform in the same staggered relation, a movable element operable adjacent said platform for engaging and shifting the rows of articles on said platform into a compact staggered formation, and means actuated by the movement of said lifting means for moving said element into and out of engagement with said deposited articles on said platform.

3. In a machine for feeding spaced rows of articles and for arranging them in a staggered formation, the combination of a conveyor for feeding a plurality of spaced parallel transverse rows of the articles into a transfer station to form a unit layer of articles having adjacent rows in staggered relation, means for operating said conveyor a predetermined distance to advance the desired number of rows to form said layer of articles, control means operable by the articles received in said transfer station for stopping said conveyor when the required number of articles is advanced to locate said unit layer of articles in a predetermined position at said transfer station, a platform located adjacent said conveyor at a compacting station, a lifting device movable relative to said conveyor and to said platform, gripper means carried on said lifting device for engaging the positioned rows of articles in the layer on said conveyor for lifting them therefrom and for depositing them as a unit of spaced rows onto said platform, a pusher member movable adjacent said platform for engaging and shifting the staggered rows of articles into closely contacting relation to transform the transferred articles on said platform into a compact staggered formation, and fluid pressure means actuated by the movement of said lifting device for moving said pusher member into shifting engagement with said deposited articles.

4. In a machine for feeding spaced rows of articles and for arranging them in a desired formation, the combination of a conveyor for feeding the articles by rows into a transfer station, a platform located adjacent said conveyor at a compacting station, a transfer carriage having fluid pressure means for moving the same between said stations, a lifting device carried on said carriage and movable therewith, said lifting device being movable between said carriage and said conveyor at said transfer station and between said carriage and said platform at said compacting station, a plurality of suction cups carried on said lifting device and connected to a vacuum line leading to a source of vacuum for picking up a plurality of rows of the articles from said conveyor and for holding them in suspension during movement of said carriage and for depositing the rows of articles as a unit layer onto said platform, fluid pressure means for raising and lowering said lifting device and for moving said carriage in opposite directions between said stations, a movable pusher member operable adjacent said platform for engaging and shifting the rows of transferred articles on said platform into a compact pattern formation, fluid pressure means for moving said pusher member, and means actuated by said lifting device for vacuumizing said cups through said vacuum line and for actuating said fluid pressure means to move said carriage and said pusher member in synchronized relation.

5. In a machine for feeding spaced rows of containers and for arranging them in a staggered pattern formation, the combination of an intermittently operated conveyor for feeding a plurality of spaced transverse rows of containers, means carried by said conveyor for staggering adjacent unit rows of articles thereon, a platform located adjacent said conveyor, a lifting device horizontally reciprocable between said conveyor and platform and vertically movable relative to said conveyor and to said platform for lifting

the articles in staggered rows as a unit layer from the conveyor and for depositing them on said platform, a plurality of vacuum cups arranged in spaced staggered rows on said lifting device and connecting with a vacuum line leading to a source of vacuum for gripping and holding the containers in their staggered row relation during movement of said lifting device, fluid pressure means for reciprocating and raising and lowering said lifting device, an electric control valve for effecting the operation of said fluid pressure means, electric means connecting with said valve and operable by the vacuum in said vacuum line for delaying the lifting movement of said lifter device until a sufficient vacuum is created in said vacuum cups to insure the gripping and lifting of the containers, a pusher member reciprocable over said platform for engaging and shifting the rows of deposited containers thereon into a compact formation, means on said platform and disposed on opposite ends of the rows of containers on the platform for retaining the staggered pattern formation during compacting thereof by said pusher member, and fluid pressure means actuated by the vertical movement of said lifting device for reciprocating said pusher member for the described purpose.

6. In a machine for feeding spaced rows of containers and for arranging them in a pattern formation, the combination of a conveyor for feeding said rows of containers, a platform located adjacent said conveyor, a transfer device having means for moving the same between said conveyor and said platform for elevating the articles as a unit layer from said conveyor and for transferring them to said platform, means including a plurality of suction cups carried on said transfer device and connecting with a vacuum line leading to a source of vacuum for gripping and holding the containers during movement of said transfer device, means for elevating and lowering said transfer device, means exposed to and operable by the vacuum in said line for delaying the elevation of said transfer device until a sufficient supply of vacuum is present in said suction cups to insure the gripping and elevation of the containers, a movable pusher member operable adjacent said platform for engaging and shifting the transferred containers on said platform into a desired compact pattern formation, and means actuated by the movement of said transfer device for moving said pusher member into engagement with said transferred containers for the purpose described.

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