

Dec. 8, 1964

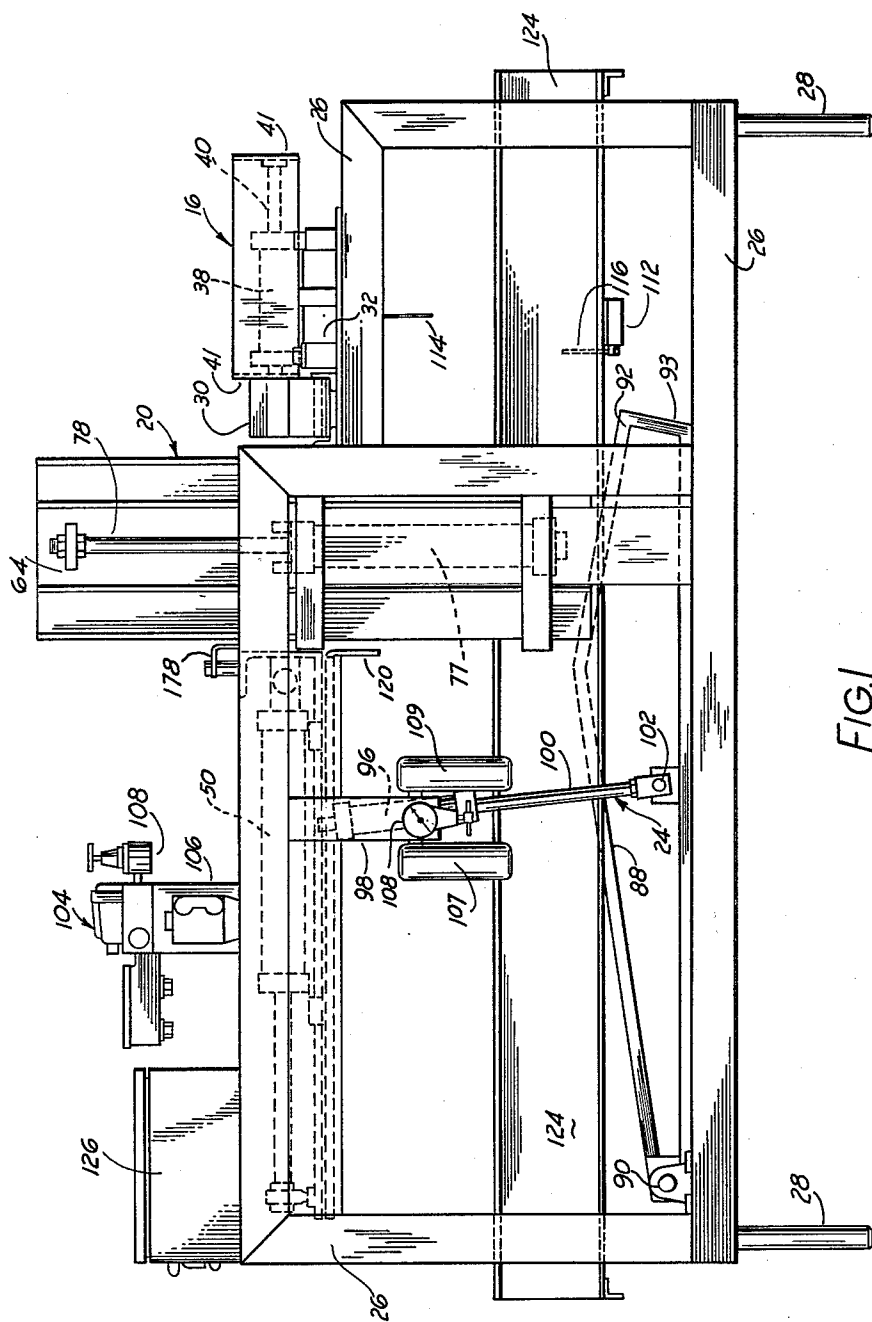
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3,159,954

CASING MACHINE

Filed March 5, 1962

7 Sheets-Sheet 1



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CASING MACHINE

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7 Sheets-Sheet 2

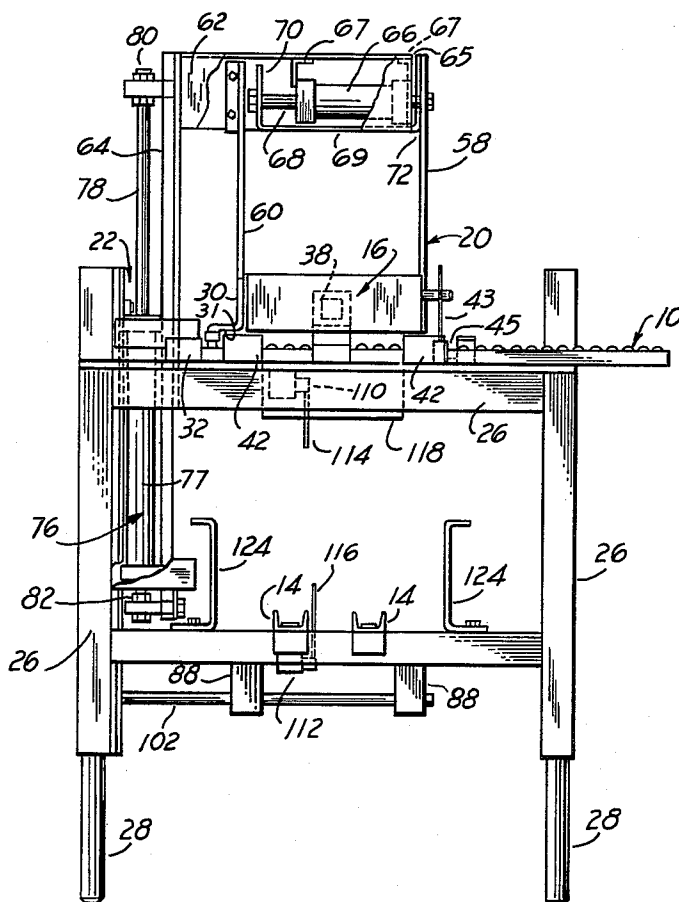


FIG. 2

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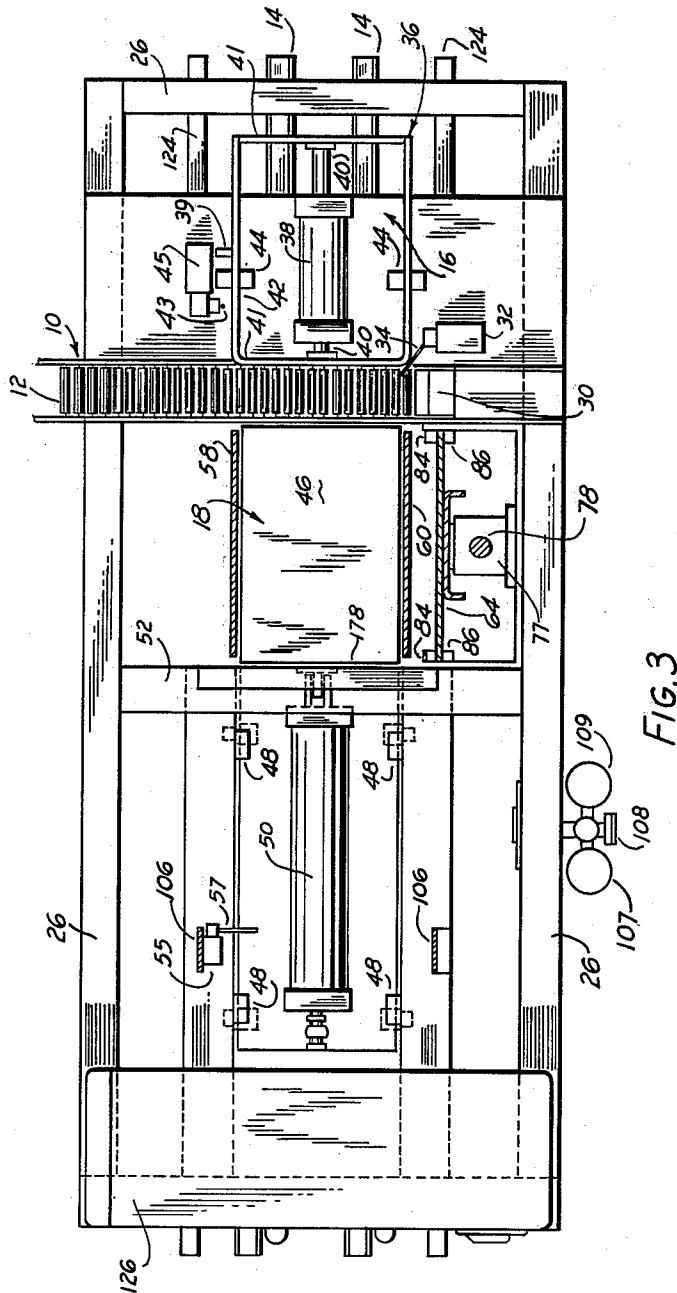
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CASING MACHINE

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7 Sheets-Sheet 3



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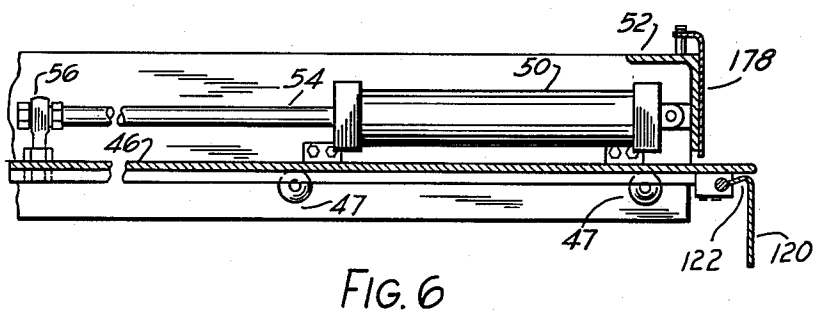
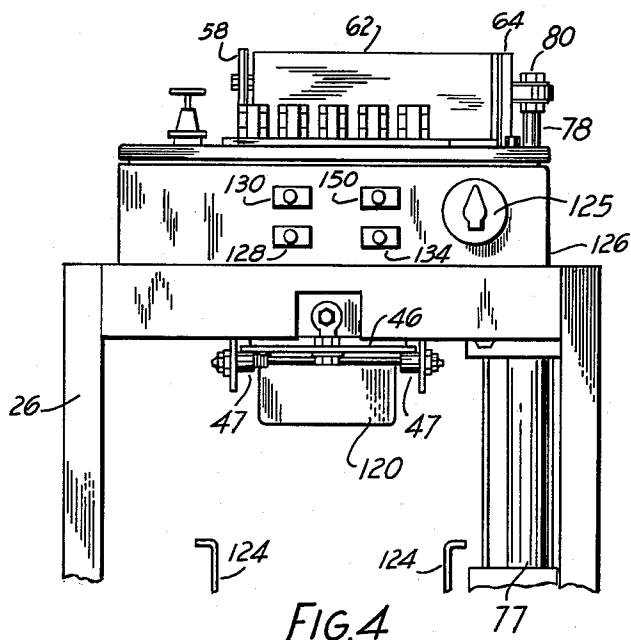
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CASING MACHINE

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7 Sheets-Sheet 4



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CASING MACHINE

3,159,954

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7 Sheets-Sheet 5

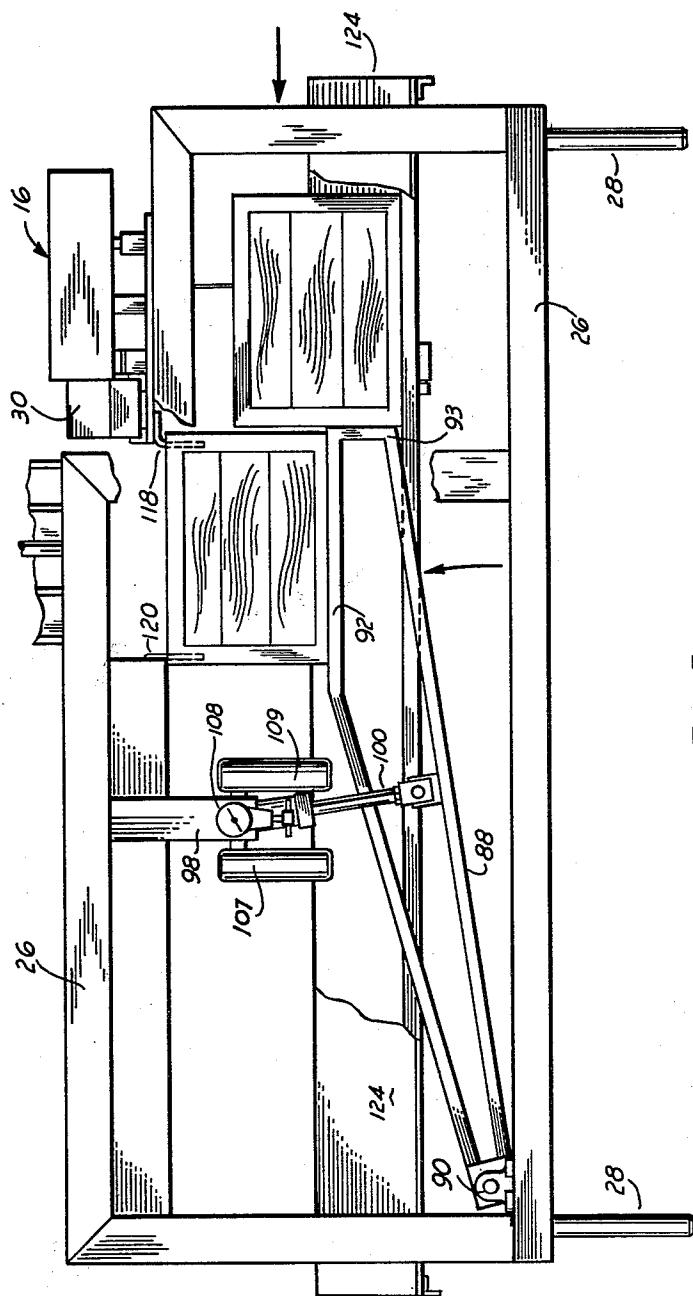


FIG. 5

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CASING MACHINE

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7 Sheets-Sheet 6

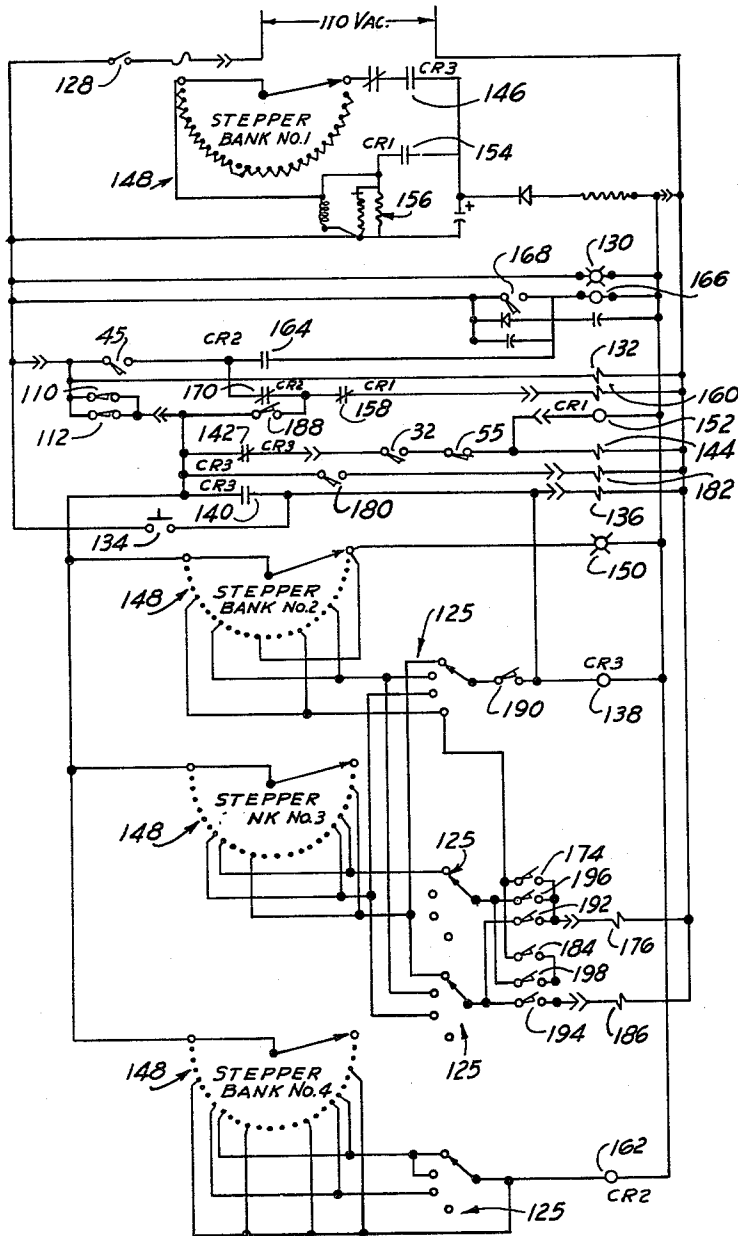


FIG. 7

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CASING MACHINE

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7 Sheets-Sheet 7

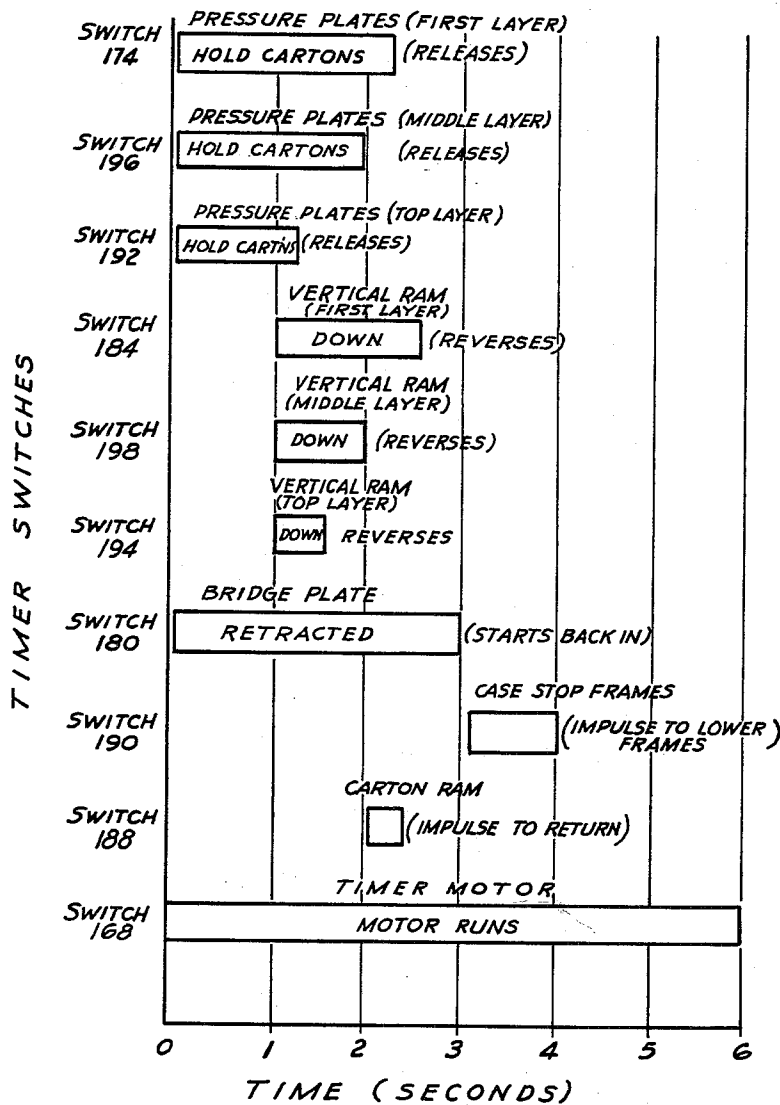


FIG. 8

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3,159,954

CASING MACHINE

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Filed Mar. 5, 1962, Ser. No. 177,485

12 Claims. (Cl. 53—61)

This invention relates to casing machines, and more particularly to machines for receiving articles single file from a conveyor, automatically grouping them and placing them into an empty case.

Many machines of various types have been designed for automatically placing small, individual articles into shipping containers, crates and cases. These machines, commonly referred to as "casers," eliminate a very tedious job normally done manually by one or more persons. Casers of the type to which this invention relates are continuously fed the articles to be cased in a single file from a conveyor. The caser will group the articles into rows and then transfer the rows to a grouping station where several rows are accumulated and placed into an empty case. The empty cases also are continuously fed to the caser single file. There are many different casers designed to perform these functions, but all the casers known to us are complex, expensive, require frequent maintenance and attention, and are relatively difficult to service. Also, since a caser is normally installed near the end of the article conveying line and receives the articles as they are discharged from the filling machine, it is desirable that casers be capable of handling the individual containers or articles at at least the same rate as the fillers. It is, of course, highly desirable that the caser be as trouble-free as possible since a breakdown or failure in its operation will usually necessitate shutting down the entire processing line. Thus, if these machines are unreliable or inefficient, they hinder rather than improve the overall processing operation.

Because of the unreliability, inflexibility and expense of prior art casers, the owners and operators of many processing plants continue to perform the casing operation by hand in spite of the many disadvantages of manual handling. This is particularly true since there are very few machines known to us that are capable of handling articles of different sizes. For example, in dairy plants it is common practice to bottle and distribute milk products in a variety of containers and sizes—half-gallon, quart, third-quart, pint, and half-pint in both paper and glass bottles are standard sizes. All of the different sizes of paper cartons, with the exception of the half-gallon carton, are filled with liquid by the same filling machines, and are carried by the same conveyor lines. They are also placed in the same cases, but in different layering patterns. Moreover, in the usual dairy operation, it is not uncommon to bottle quarts, half-pints, pints, and third-quarts all in the same day. Therefore, it would be a great advantage to have a caser capable of automatically handling all sizes of cartons and placing the correct number and layers of each into a case. There is no caser known to us that can handle all carton sizes and change quickly and easily from one size to the other.

It is therefore a principal object of our invention to provide a casing machine that is capable of casing any size of paper carton automatically, the change from one carton size to another being quickly and easily made by changing the position of a selector switch.

It is another object of our invention to provide a casing machine that will handle all types of cases regardless of their structure and regardless of slight variations in their overall dimensions. There is a wide variety of

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cases used by dairies and other food processors and our novel machine will handle all types without the risk of jamming due to the variation in case size causing improper positioning of the case. It is our intention also to provide a casing machine that will receive and discharge the cases in their normally conveyed position thereby eliminating any necessity for turning the cases 90° after they have been filled and discarded from the caser. With some machines, the cases become turned sideways during the casing operation and they must be turned after filling or they will not enter the case stacker, a piece of machinery that is commonly installed in the case conveyor line after the casing machine.

It is a still further object of our invention to provide a casing machine that can be quickly and easily modified to handle cases requiring different layering patterns. The most commonly used case for milk cartons holds four rows of four cartons each. However, there is also the size "20" case which holds five rows of four cartons each and the "24" case which can hold six rows of four cartons each.

It is another object of our invention to provide a casing machine in which the various operations are dependent primarily on time rather than on sequence of operation. It is our purpose, therefore, to provide a casing machine which is less likely to jam since each operation will be performed at a predetermined time regardless of failure of any previous operation. Thus, the machine will continue to operate and, in effect, clear the jam itself.

It is another object of our invention to provide a casing machine in which the case is positively positioned to receive the cartons therefore eliminating the possibility of the machine jamming because of the improper position of the case.

It is a still further object of our invention to provide a casing machine that will fill the cases with cartons even though the cases are fed intermittently into the machine. In so doing, it is our purpose to provide means that will prevent the machine from starting a casing cycle unless a case is in position to receive the cartons.

It is a still further object of our invention to provide means for guiding the cartons into the individual cases from all four sides thereby assuring that the cartons will all be placed inside the case and minimizing the possibility of damage to the cartons.

It is a still further object of our invention to provide a casing machine which can be easily converted from a right hand to a left hand machine. In other words, our casing machine can be installed to receive cartons from either the right or left hand side of the case conveyor.

It is a still further object of our invention to provide a casing machine that is relatively simple in construction and operation, the caser being air-operated and controlled by an electrical circuitry that is entirely contained in a control box which can be remotely located. Thus, it is our purpose that if a failure in the electrical control system occurs, a replacement control box can be installed in minutes and used while the control system is checked and repaired. This, of course, minimizes down time for repairs. Because of its relative simplicity, our novel caser is less expensive in initial price and less expensive to maintain than machines of the prior art.

These and other objects of our invention will be readily apparent from a consideration of the following description taken in connection with the accompanying drawings in which:

FIG. 1 is an elevational view of the left side of our novel caser shown with all the covers removed to disclose the details of its construction;

FIG. 2 is an end view of our novel casing machine looking at the machine in the direction of the case movement;

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FIG. 3 is a top plan view of the machine shown with the upper portion of the structure removed;

FIG. 4 is a view of the upper portion of the case discharge end of the machine;

FIG. 5 is an elevational view similar to FIG. 1 but with part of the structure broken away to show the case stop assembly;

FIG. 6 is an enlarged side view of the bridge plate assembly;

FIG. 7 is a schematic wiring diagram of the control system of our novel casing machine; and

FIG. 8 is a chart illustrating the time sequence of the various operations that are controlled by the multiple switch timer which is a part of the control system.

Referring now to the drawings, our novel casing machine is shown in detail. For purposes of illustration, we have shown and will describe a right-hand machine for casing paper cartons for milk products, the machine being for cases holding four rows of four cartons each. The cartons are fed to the casing machine from the right side by a moving conveyor (not shown) onto the free conveyor 10 that consists of a plurality of rollers 12 preferably made of a long-wearing material such as nylon. The cartons will be pushed along the free conveyor 10 as they accumulate thereon from the moving conveyor. Although our caser is easily constructed so that the cartons can be fed from either the right or the left side of the machine, the cartons are shown for purposes of illustration being fed into the right side of the machine.

In order to simplify installation, the caser preferably is installed in a case conveyor line (not shown) so that the empty cases are fed into the machine at right angles to the carton conveyor. The casing machine shown is adapted for use with a conveyor of the drag-chain type, and thus guide channels 14 are provided for the conveyor chains. The cases are moved through the machine from the entrance end of the machine shown in FIGURE 2, to the case discharge end shown in FIGURE 4.

To handle the cartons and cases as they are fed into the caser, we have provided a carton ram 16, a carton grouping station 18, holding means 20 for the grouped cartons, carton lowering assembly 22, and a case stop assembly 24. Each of these sub-assemblies will be described in detail hereinafter.

The casing machine has a main framework 26, generally rectangular in shape, that is supported on four legs 28. The conveyor 10 is fixed to the framework 26 near the entrance end of the caser. As the cartons accumulate on the conveyor 10 they will be moved from right to left until the first carton in line contacts a carton stop 30. The lower portion of the stop 30 extends inwardly so that when a carton contacts the stop 30, a space 31 remains below the stop 30. A limit switch 32 is mounted adjacent the top 30 and has an actuating lever 34 extending into the path of cartons on the conveyor 10 and movable into and out of the space 31 below the stop 30. Thus, as the cartons on the conveyor 10 approach the case stop 30 they will engage the actuating lever 34 of limit switch 32 and push the lever 34 into space 31. This trips the limit switch 32 which controls the carton ram 16.

The carton ram 16 consists of a rectangular-shaped frame 36 surrounding and secured to an air operated cylinder 38 that is fixed to the framework 26 in the center of the frame 36. The air cylinder 38 is of the double-acting type and has a piston rod 40 extending from each end thereof. The piston rod 40 is connected at its ends to two opposite ends 41 of the frame 36. Thus, by action of the cylinder 38, the frame 36 will move across the conveyor 10 and, as will be described more fully hereinafter, a trip arm 39 extending from the side 42 of frame 36 will strike the actuating lever 43 of a limit switch 45 that causes the ram 16 to return to its original position. The frame 36 is floatingly mounted on the piston rods 40 and is preferably additionally guided by sliding on nylon blocks 44 that are also fixed to framework 26. Note

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that the ram 16 must be mounted at a level slightly above the top surface of conveyor 10 and also is at a level above the space 31. The latter allows the actuating lever 34 of limit switch 32 to return to its original position just after the carton ram 16 pushes a row of cartons off conveyor 10. The stroke of the ram 16 is short, being just long enough to push the cartons off the conveyor 10. Side 42 of the frame 36 acts as a carton stop while the ram 16 moves forward and returns.

The carton ram 16 pushes the row consisting of four cartons off the conveyor 10 into the carton grouping station 18 where the cartons are supported on a bridge plate 46. The bridge plate 46 is movable in a horizontal plane to and from a carton supporting position, shown in FIG. 3, on rollers 47 and is guided by a pair of nylon blocks 48 mounted on the framework 26 on each side of the bridge plate 46. Movement of the bridge plate 46 is powered by an air cylinder 50 that has one end fixed to a cross member 52 of the frame 26. A piston rod 54 extends from the other end of air cylinder 50 and is connected by means of an eye bolt 56 to one end of the bridge plate 46. As air is supplied to the cylinder 50 and the piston rod 54 is forced outward (to the left in FIG. 3) the bridge plate will be retracted from the carton supporting position. To prevent cartons from being pushed by ram 16 into the carton grouping station 18 when the bridge plate 46 is retracted, a limit switch 55 is located so that its actuating lever 57 will be engaged by the bridge plate 46 when in carton supporting position thereby holding the switch 55 closed. However, if the bridge plate 46 is not in proper position, switch 55 will be open preventing the advance of carton ram 16.

Before the bridge plate 46 is retracted from its carton supporting position, other means must be provided to hold the group of cartons. Therefore, we have provided the carton holding means 20 which includes two depending pressure plates 58 and 60 that are substantially parallel and relatively movable to one another to squeeze and thereby hold the group of cartons. Pressure plate 60 is rigidly secured to a housing 62 that has a cross-sectional shape resembling an inverted U. Housing 62 is fixed at one end to a vertically-disposed supporting plate 64. The opposite end 65 of housing 62 is open. Secured by brackets 67 to the inside of housing 62 and partially enclosed by the latter is a double-acting air cylinder 66 that has a piston rod 68 extending from each of its ends. A U-shaped member 69 straddles cylinder 66 and has its upturned ends 70 and 72 secured to the ends of piston rod 68. End 72 of member 69 is rigidly connected to pressure plate 58 at the open end 65 of housing 62. Thus, air supplied to the cylinder 66 will move member 69 and cause the pressure plate 58 to move relative to pressure plate 60 while at all times maintaining its parallel relationship to pressure plate 60.

The pressure plates 58 and 60 extend downward and in the "open" position each is in a vertical plane along a side of the bridge plate 46. However, the bottom edges of plates 58 and 60 are at a level slightly above the top surface of the bridge plate 46 so that plate 58 may move freely toward plate 60 to grip a group of cartons and hold them while the bridge plate 46 is withdrawn.

In order to lower into a case the cluster of cartons held by pressure plates 58 and 60, we have provided the cluster lowering means 22, which includes the vertical plate 64 that is supported on a vertically disposed ram 76. Ram 76 consists of an air cylinder 77, preferably of the double-acting type, which is securely fixed in any suitable manner to the framework 26. A piston rod 78 extends from both ends of cylinder 77 and is connected at its ends to the opposite ends of the vertical plate 64 by means of eye bolts 80 and 82. When moved by ram 76, the vertical plate 64 is guided by nylon blocks 84 and rollers 86 that are secured to the frame 26. Thus, when air is supplied to the vertical ram 76, the vertical plate

64 will be moved downward carrying with it the entire cluster holding means 20.

Since the case conveyor chain (not shown) moves continuously in guide channels 14, means must be provided to hold a case in position to receive the cluster of cartons and to stop additional cases until the first case has been discharged from the casing station. To accomplish this we have provided a case stop assembly 24. This assembly 24 consists of a pair of frames 88, one mounted on each side of the casing machine adjacent the guide channels 14. Each frame 88 is pivotally mounted at its end 90 to move in a vertical plane and has a top bar 92 which engages the case to raise it off the case conveyor. The end bars 93 of frames 88 serve as the case stop when the frames 88 are raised above the case conveyor. In order to lift the frames 88 we prefer to connect them together by a cross-bar (102) and provide on one side of the caser a double acting, air-operated cylinder 96 pivotally mounted at its end on the inside of a depending support 98 that is secured to the caser on the upper part of the frame 26. The piston rod 100 of air cylinder 96 is pivotally connected at its end to cross bar 102. Similar to the other air cylinders used in our novel casing machine, when air is supplied to the cylinder 96, the piston rod 100 will raise the frames 88 thereby lifting the case off the case conveyor. Similarly, control of the air supplied to cylinder 96 will cause the piston rod 100 to be extended and the frames 88 lowered.

To control the air supply to all of the air-operated cylinders in our novel caser we provide a group of solenoid-operated air valves, all of which are indicated generally by the reference numeral 104. These valves 104 are mounted for easy accessibility on a suitable support 106 at the top of the frame 26. Valves 104 may be of any suitable type, and since the details of their construction and operation is well known to those in the art, further explanation will not be made. Also, one or more pressure regulators 108 are provided to control the air pressure supplied to each of the air cylinders in the system. The pressure for each cylinder depends upon the function it performs and the pressure should be high enough to perform the desired function but as low as possible to minimize excessive jolts and noise in the machine. In addition, low pressures are a safety factor. We also provide an air lubricator 107 and an air filter unit 109 that are mounted on the outside of depending support 98 and are connected in the air supply line prior to regulators 108 and the solenoid valves 104.

To control action of the case stop assembly 24 we prefer to provide two limit switches 110 and 112 which have trip arms 114 and 116 respectively. The reason for having two limit switches rather than one will be explained hereinafter in the description of the control circuit. However, it is sufficient at this time to say that both trip arms 114 and 116 must be engaged by an incoming case before the case frames 88 will be raised by actuation of air cylinder 96.

As best seen in FIG. 5, we have provided a case positioning member 118 that is rigidly fixed to the frame 26 at a level just below the carton conveyor 10. Member 118 is located so that it will engage the inside of the case to assist in positively positioning the case in the proper location to receive the cluster of cartons. The case positioning member 118 also serves the additional function of acting as a "shoe horn" to guide the cartons into the case as they are lowered by the cluster lowering means 22.

A case is generally pushed against member 118 and thus into proper position by force of the next case on the case conveyor. However, in some instances this will not happen particularly with the last case or if the cases are intermittently fed to the machine. Therefore to assure proper positioning of the case to receive the cluster of cartons we have provided a second positioning member 120, the cross-sectional shape of which resembles an in-

verted L. Member 120 is pivotally secured at the outer edge of its leg 122 to the bottom of the bridge plate 46. The positioner 120 is mounted so that it will pivot in only the direction indicated by the arrow in FIG. 6.

The positioning member 120 serves to assure proper positioning of the case as follows. When the bridge plate 46 is in carton supporting position, the positioning member 120 will be adjacent the other case positioning member 118. Normally, a case is raised into carton-receiving position by the case frames 88 and the next case will push it into position against member 118. At this time, both the positioning member 118 and the member 120 will be inside the case. When the bridge plate 46 is retracted to permit lowering of the first layer of cartons into the awaiting case, the positioning member 120 will be pulled to the left (FIG. 5). If the case is not in proper position, possibly because it is the last case in line, the positioning member 120 will engage the inside leading edge of the case and pull it to the left (FIG. 5) until the inside trailing edge of the case engages the member 118. In this position the case will be in the exact position for receiving the cluster of cartons.

The positioning member 120, similar to member 118, also serves the additional function of guiding the cartons into the case as they are lowered by the cluster lowering means 22. In other words, the members 118 and 120 act as a "shoe horn" for the cartons.

In order to position the cases laterally within the caser and also to guide them as they travel through the machine, we provide on each side of the conveyor chain guides 14 channel-shaped members 124 that are spaced apart a distance slightly more than the width of a case. These channels 124 extend from the entrance end to the discharge end of the caser, and their height is sufficient to guide and position the cases when they are raised by the frames 88 in position to receive a cluster of cartons. FIG. 5 shows a case in the raised position with the lower edge of the case between the guide channels 124, thus assuring its proper lateral position to receive a cluster of cartons.

The mechanical structure of our novel casing machine has been described and it is obvious that it is relatively simple. To perform the various functions in their proper sequence automatically, we have provided a novel electrical control system which is shown schematically in FIG. 7. For the purpose of clarity, the control circuit will be described in operating sequence of the caser. However, one of the advantages and features of our novel caser is that it can handle cartons of various sizes, and we will therefore describe first the control system as it operates for quart size cartons which have the simplest operating sequence. Pint, one-third quart and half-pint cartons all follow an operating sequence similar to quarts, the principal difference being a variation in the layering pattern. The common layering patterns for the various standard size milk cartons are shown in the following table, the second figure indicating the number of rows of cartons:

Carton Size	1st Layer Cluster	2nd Layer Cluster	3rd Layer Cluster	Total Cartons
Quart.....	4 by 4	-----	-----	16
Pint.....	4 by 4	4 by 3	-----	28
1/2 Quart.....	4 by 4	4 by 4	-----	32
1/2 Pint.....	4 by 4	4 by 4	4 by 3	44

We provide a selector switch 125 located on a control 126, that permits the operator easily to set the caser for the desired carton size. This switch 125 will be referred to in more detail later. Proceeding now with the description of the control circuit as it operates for quart-size cartons, we prefer that all possible electrical controls be contained in the control box 126 which is preferably mounted on the upper portion of the caser at the discharge end but can also be located at some remote place. Con-

trol box 126 contains all of the electrical controls with the exception of the operating limit switches, and thus it is a simple matter to install a complete, new control system if it becomes necessary to service the control system. This obviously greatly reduces "down time" of the caser and therefore increases its operating efficiency.

To start the caser, the operator first throws on the toggle-type switch 128 which is preferably located on the control box 126. With switch 128 on, indicator light 130 will light indicating the power is now being supplied to the control circuit and the solenoid operated main air-valve 132 will be energized thereby supplying air to the system.

With electrical power being supplied to the control circuit and air being supplied to the air system the caser is now ready to start a casing cycle. Assuming that the case frames 88 are in the case stop position, the operator must press the case release push-button switch 134 that is located on the control box 126. This is necessary only once to allow the first case to enter the machine. Subsequent cases are automatically admitted into the caser. As will be apparent from FIG. 7, when the case release button 134 is pressed, the case stop solenoid 136 will be energized supplying air to cylinder 96 thereby lowering the case stop frames 88. Simultaneously with energization of the case stop solenoid 136, the CR3 relay coil 138 will be energized. This in turn will cause the CR3 normally-open contacts 140 to close maintaining the circuits to CR3 coil 138 and the case stop solenoid 136 thereby keeping the case stop frames 88 down below the level of the case conveyor.

Also, when CR3 coil 138 is energized, the CR3 normally-closed contacts 142 in the circuit controlling the carton ram 16 will open thereby making dead the circuit to the solenoid valve 144. Valve 144 controls the air supply to cylinder 38 that operates the carton ram 16, and with the circuit to valve 144 open, ram 16 is prevented from pushing cartons into the case-grouping station 18 while the case stop frames 88 are lowered. Thus, the operations of grouping the cartons and placing them into a case can not start until the frames 88 have raised an empty case into position.

Energization of CR3 coil 138 will also close CR3 normally open contacts 146 which are in circuit with bank #1 of a rotary stepping switch 148. This "homes" the switch 148 and lights an indicator light 150 on the control box 126 to show that the control circuit is ready to start a cycle.

The stepping switch 148 is of the magnetic-solenoid-operated type of any suitable design that has a sufficient number of banks of wipers to control the desired carton layering patterns; such switches are manufactured, for example, by the Automatic Electric Company of Chicago, Illinois. We have chosen for the system disclosed herein a switch that has four banks of wipers. This stepping switch 148 is, in effect, an electrical counter which opens or closes selected circuits as the switch is stepped or advanced to the next set of contact points. The switch 148 is "stepped" each time a stepping coil 156 is energized and then de-energized. This requires only an electrical impulse to coil 156. When the switch 148 is "homed," the wipers are returned to a "zero" contact point.

The lighting of the cycle light 150 when the stepping switch 148 has been homed is the signal that the caser is now ready to receive an empty case and start the casing of the cartons. With the case stop frames 88 in a downward position, empty cases being carried on the case conveyor will enter the machine. As the first empty case reaches the caser, its leading edge trips the actuating rod 114 momentarily opening limit switch 110. However switch 110 is in parallel with switch 112 which is still closed completing the circuit to case stop solenoid 136. Therefore, case frames 88 will remain down and the case will continue to travel until it depresses and holds down

the actuating lever 116 on the lower case limit switch 112, and the trailing edge of the case again trips 114 of the upper switch 110. Both switches 110 and 112 are now held open momentarily thereby breaking the circuit to the CR3 normally-open holding contacts 140 de-energizing CR3 coil 138 which in turn de-energizes the solenoid valve 136. Solenoid valve 136 regulates air pressure to the cylinder 96 causing the case frames 88 to raise the case into carton-receiving position, the end bars 93 stopping the travel of any other cases. De-energization of the CR3 coil 138 will close the normally-closed contacts 142 in the circuit to solenoid valve 144, which when energized supplies air to cause the carton ram 16 to advance forward. Also, as the empty case is raised by action of the case frames 88 the limit switches 110 and 112, which are in the same circuit with solenoid 144, will close. Thus, with the empty case in position to receive cartons, the solenoid valve 144 will be energized when the limit switch 32 is closed by action of the cartons on conveyor 10, assuming that the bridge plate 46 is in carton supporting position thereby holding closed the limit switch 55.

Closing of the limit switches 110 and 112 as the case is raised by frames 88 will also activate the circuit to the stepping switch 148.

As the cartons reach the conveyor 10, they accumulate into a solid row with no space between them. When sufficient cartons have accumulated on conveyor 10 to push the leading carton against the stop 30 at the end of conveyor 10, the lever 34 is tripped closing limit switch 32. This energizes CR1 relay coil 152 and causes the normally-open CR1 contacts 154 to close energizing the stepping coil 156. However, this does not step the switch 148. Also, the normally-closed CR1 contacts 158 open making it impossible to complete the circuit to the carton ram return solenoid valve 160 which supplies air to the carton ram air cylinder 38 to return the carton ram 16 to its initial position. This is an additional safety feature to prevent possible damage to the carton ram solenoid valves.

Closing of switch 32 also completes the circuit to the solenoid valve 144 causing air to be supplied to the cylinder 38 which advances the carton ram 16 pushing a row of four cartons onto the bridge plate 46. Note again that if the bridge plate 46 is not in carton supporting position, the limit switch 55 will be open preventing energization of the solenoid valve 144, and the carton ram 16 will not advance even though limit switch 32 is closed by the accumulated cartons on conveyor 10. However, assuming bridge plate 46 is in proper position, the carton ram 16 will start its advance, and when the cartons are pushed off conveyor 10 limit switch 32 opens de-energizing CR1 relay coil 152 and de-energizing the carton ram solenoid valve 144, which cuts off the air supply that moves carton ram 16 forward. Also, as the carton ram 16 advances, side 44 of ram 16 holds back the other cartons accumulating on conveyor 10.

De-energization of CR1 coil 152 closes the normally-closed CR1 contacts 158 in the circuit to the carton ram return solenoid 160. Also, the normally-open CR1 contacts 154 will open de-energizing the stepping coil 156 and stepping the stepping switch 148 one count. In other words, the wipers of all four banks of switch 148 advance one step to the first contact point in each stepping bank. However, none of the first contact points are connected in circuits, and nothing happens except cycle light 150 will go out.

As the carton ram 16 reaches the end of its stroke with the row of cartons on bridge plate 46, the trip arm 39 on ram 16 strikes the actuating member 43 closing limit switch 45 thereby completing the circuit to the carton ram return solenoid valve 160. Solenoid 160 is energized and supplies air to cylinder 38 which returns the carton ram 16 to its original position. As carton ram 16 returns, switch 45 will open de-energizing the ram return solenoid 160, and when the carton ram 16 has returned to its

original position accumulated cartons will be pushed along the conveyor 10 toward the stop 30. When the leading carton reaches the stop 30, it closes limit switch 32 and starts another cycle to push a row of cartons onto bridge plate 46. This cycle is repeated until three rows of cartons are on bridge plate 46 and during each cycle the stepping switch 148 is stepped to another contact point.

Since the layering pattern for quart size milk cartons consists of four cartons in each of four rows, the stepping switch 148 is set so that when the fourth row of cartons is pushed onto bridge plate 46 and de-energization of the stepping coil 156 steps all wipers of switch 148 to the fourth contact points the following will happen. Stepper bank No. 2 will activate a circuit to CR3 relay coil 138. Also, at the fourth contact point, stepper bank No. 4 will complete a circuit to energize CR2 relay coil 162. This closes the normally-open CR2 contacts 164 which are in a circuit leading to a motor 166 for a timer.

The timer is preferably of the multiple switch type, the switches being opened and closed by the action of cams driven by the timer motor 166. Cam timers of this type are well known to those skilled in the art and since their specific structure is not a part of our invention, they will not be described in detail. A timer suitable for use in our novel system can be obtained, for example, from the Industrial Timer Corporation of Newark, New Jersey. In timers of this type it is possible to adjust the cams to open and close circuits at desired time intervals throughout the total time cycle of the timer.

Even though the normally-closed CR2 contacts 164 are closed the timer motor 166 is not started since it is in circuit also with the limit switch 45 which is open. When the CR2 relay coil 162 is energized by the fourth contact point of stepper bank No. 4 the normally-closed CR2 contacts 170 will open making the circuit to the carton ram return solenoid valve 160 dead. As the carton ram 16 moves forward to the fully advanced position, the limit switch 45 closes. However, the carton ram 16 remains in the fully advanced position since the normally-closed CR2 contacts 170 are open thus preventing switch 45 from completing the circuit to the carton ram return solenoid 160. However, closing of the limit switch 45 completes the circuit to the timer motor 166. This starts the timer cams on a cycle of one revolution, and one of the timer cams immediately closes and holds closed a switch 168 in circuit with motor 166. This keeps the timer motor 166 running until switch 168 opens at the end of one revolution of the cams.

At this point in the operation of the caser a layer of sixteen cartons is being supported on the bridge plate 46 and the carton ram 16 is being held in the fully advanced position. Also, an empty case is in the raised position supported by the case frames 88. When the timer starts a cycle, the motor-driven cams in the timer will open and close the various timer switches in the following sequence.

Timer switch 174 closes first thereby completing the circuit to a solenoid air valve 176 that controls the air pressure to cylinder 66 which controls movement of the pressure plate 58. Thus pressure plate 58 will be pulled toward pressure plate 60 and the two plates 58 and 60 will grip the layer of cartons from two sides with sufficient pressure to hold them in a group. The cartons are kept in the group by a dead plate 178 on the third side and by the advanced carton ram 16 on the fourth side. The pressure exerted by the pressure plates 58 and 60 can be regulated by adjusting the air pressure supplied to the air cylinder 66, thus assuring sufficient pressure to hold the cartons without damaging them.

Next in sequence the timer switch 180 will close and complete the circuit to a solenoid air valve 182 controlling the air pressure to air cylinder 59. The solenoid valve 182 will be energized to cause cylinder 59 to retract the bridge plate 46. As the bridge plate 46 is retracted, the trip lever 57 will be released opening limit switch 55. This opens the circuit to the carton ram forward solenoid

valve 144 thereby assuring that solenoid valve 144 cannot be energized at the same time the carton ram return solenoid 160 is subsequently energized by action of the timer. This is a safety feature that prevents damage to the air cylinder 38 for the carton ram 16.

With the bridge plate 46 retracted, the group of cartons being held by pressure plates 58 and 60; the timer switch 184 closes energizing a solenoid valve 186 which controls the air supply to the vertical ram 76. Therefore, vertical ram 76 starts the carton lowering assembly 22, which includes the pressure plates 58 and 60, moving downward. At or near the bottom of the downward stroke of vertical ram 76, the timer switch 188 closes and immediately opens to send an electrical impulse to the carton ram return solenoid 160 thereby returning the carton ram 16 to its original position. Although carton ram 16 and deadplate 178 serve to hold the group of cartons from two sides, the case positioners 118 and 120, together with the pressure plates 58 and 60, will assure that the cartons are held and guided from all four sides during the entire time the cartons are being lowered into the case. When the carton ram 16 has returned to its original position, the actuating lever 43 is released opening switch 45 in circuit with the timer motor 166. However, once the timer is started on a cycle of one cam revolution, the switch 168 will be held closed completing a circuit to motor 166 until the end of that revolution. At that time switch 168 will open and stop the motor and the timer.

Carton ram 16 is now fully retracted and the vertical ram 76 has lowered the group of cartons into the empty case. At the bottom of the stroke of vertical ram 76, timer switch 174 will open and the pressure plates 58 and 60 will then release the group of cartons into the case. Timer switch 184 then opens de-energizing solenoid valve 186 to reverse the stroke of vertical ram 76 raising the carton holding assembly 22. At the top of the stroke of vertical ram 76, the carton holding assembly 22 has returned to its uppermost position and timer switch 180 opens de-energizing the bridge plate solenoid valve 182 and the bridge plate 46 moves back to carton-supporting position.

Timer switch 190 now closes and then opens to send an impulse to the case stop solenoid valve 136 thereby supplying air to cylinder 96 and lowering the case stop frames 88. This lowers the filled case to the case conveyor for discharge from the caser. Simultaneously, timer switch 190 sends an impulse to CR3 coil 138 thereby closing the normally-open contacts 140 to keep the CR3 coil 138 energized. Energization of CR3 coil 138 closes the normally-open contacts 146 homing the stepping switch 148, resetting the cycle light 150, and de-energizing CR2 relay coil 162. Also, the normally-closed CR3 contacts 142 will open, thereby deactivating the circuit to the carton ram forward solenoid 144 to prevent the carton ram 16 from advancing until the next empty case is properly positioned.

The timer has now completed its cycle of one cam revolution and switch 168 will open to stop timer motor 166. At this stage the carton ram 16 is in the retracted position, the bridge plate 46 is in carton-supporting position, the case stop frames 88 are being held down (since the CR3 relay coil 138 is energized) and therefore the next empty case enters the machine and starts another cycle of operation. It is apparent that after the caser has been started on its first cycle the entire operation is fully automatic, the succeeding cycles being started by action of the empty case being carried into the caser and engaging the limit switches 110 and 112.

The description of the operating sequence with reference to the schematic wiring diagram of FIG. 7 was made using the quart-size milk carton as an example. The quart-size carton is cased in one layer of four cartons in each of four rows. However, our novel caser is designed to handle also pints, one-third quarts, and one-half pints, and the only adjustment necessary to change from one

size to the other is movement of the selector switch 125 to the desired position. Switch 125 may be of any standard type providing four positions for the four standard carton sizes.

Assuming now that pint-size cartons are to be cased, selector switch 125 is set on the "pint" position. For pints, the layering pattern is a first layer of four rows of four cartons each and a second layer of three rows of four cartons each. The operation of the caser will be identical to that for quarts for the first three rows of cartons. However, when the stepping switch 148 reaches the fourth contact point, stepper bank No. 4 will complete the circuit to energize CR2 relay coil 162 closing the normally-open contacts 164 in circuit with the timer motor 166 and opening the normally-closed contacts 170 in circuit with the carton ram return solenoid 160. The carton ram 16 advances with the fourth row of cartons and stays in an advanced position closing the limit switch 45. This completes the circuit to the timer motor 166 and starts the timer on a cycle of one cam revolution.

When the timer runs, the sequence of operation initially will be the same as it was with quarts. In other words, timer switch 174 will close energizing solenoid valve 176 for the pressure plates 58 and 60 which grip the cartons. Timer switch 180 closes energizing the solenoid valve 182 thereby retracting the bridge plate 46. The timer switch 184 then closes energizing solenoid valve 186 starting the vertical ram 76 downward with the group of cartons. Timer switch 188 sends an impulse to the carton ram return solenoid 160 to return the ram 16 to its original position. At the bottom of the carton ram's stroke, timer switch 174 opens and the pressure plates 58 and 60 release the cluster of cartons into the case. Timer switch 184 then opens and the vertical ram 76 starts upward. After the vertical ram 76 has returned upward, the timer switch 180 opens and the bridge plate 46 returns to carton supporting position.

However, with the selector switch 125 set for pints, the circuit to stepper bank No. 2 is open and closing of timer switch 190 will not complete the circuit to case stop solenoid 136 and CR3 coil 138. Therefore, the case stop frames 88 will stay in the raised position, the CR3 relay coil 138 is not energized and the stepping switch 148 is not homed. The timing cycle is now complete, switch 168 opens and the timer stops. Since the CR3 relay coil 38 was not energized the normally-closed contacts 142 remain closed, and after the bridge plate 46 returns to the carton-supporting position and closes the limit switch 45, the carton ram 16 can go forward as soon as cartons have accumulated on conveyor 10 and closed limit switch 32. Thus, the first row of the second layer of cartons will be pushed into the carton-grouping station 18 as will the second row. The stepping switch 148 is now on contact point six, having been stepped once for each of the four rows in the first layer and for the two rows in the second layer. When the stepping switch 148 reaches contact point 7, after the third row of the second layer has been pushed onto bridge plate 46, stepper banks No. 3 and No. 4 will complete circuits. Stepper bank No. 4 closes the circuit to energize CR2 coil 162 thereby closing the normally-open contacts 164 in circuit with the timer motor 166. Thus, when the carton ram 16 reaches the fully advanced position closing limit switch 47, ram 16 will remain in the fully advanced position and the timer motor 166 will be started.

Because of the setting of selector switch 125, closing of timer switch 174 will not energize solenoid valve 176. However, timer switch 192 will simultaneously close to energize solenoid valve 176 thereby causing the plates 58 and 60 to grip the cartons. Timer switch 180 will then close energizing the bridge plate solenoid valve 182 retracting bridge plate 46. Next, timer switch 194 will close starting the vertical ram 76 downward. With the type of timer we prefer to use in our novel caser, the timer cams can be set to open or close a selected switch

at a given time and hold the switch either open or closed for any desired percentage of a cam revolution. Since the case is always positioned at the same level by the case frames 88, it is obvious that the length of the stroke of vertical ram 76 must be shortened for the second and third layers of cartons. Therefore, when casing pint-sized instead of quart-sized cartons, the selector switch 125 will place the timer switch 194 in circuit with the vertical ram solenoid valve 186 rather than the switch 184. Switch 194 is set to stay closed for a shorter time interval than switch 184, and therefore the ram 76 will be supplied with air for a shorter period of time before reversing direction of its stroke when the switch 194 opens. Thus, by using the selector switch 125 and by setting three timer cams to hold their switches closed for the proper time intervals the stroke of vertical ram 76 can be accurately set for each of the three layers of cartons. By the same means the time during which the pressure plates 58 and 60 hold the group of cartons can be varied to coincide with the stroke of ram 76. Thus, we are able very effectively and efficiently to place several layers of cartons into the case.

The operation of the caser for pints after the last row of the last layer of cartons has been placed in the case is identical to that for quarts. Thus, with stepper bank No. 3 on contact point 7 and with the selector switch 125 set for pints, the closing of timer switch 190 will energize CR3 relay coil 138 to home the stepper and to lower and hold down the case stop frames 88 thereby discharging the filled case. A new casing cycle will be started automatically when another empty case enters the machine and engages the limit switches 110 and 112.

When one-third quarts are cased, the first layer contains four rows of four cartons each, and the second layer contains four rows of four cartons each. This layering pattern is identical to that for pint cartons except that the second layer has one additional row. FIG. 7 shows that our control circuitry has been designed so that when selector switch 125 is set for one-third quarts, the casing cycle will be identical to the cycle for pints except that the cycle will not be complete until stepping switch 125 has reached contact point 8. At that time, the case will be filled and discharged from the caser.

Half-pint sized cartons are normally cased in three layers, the first layer consisting of four rows of four cartons each, the second layer of four rows of four cartons each, and the third layer of three rows of four cartons each. Thus, the layering pattern for the first two layers is identical to that for one-third quarts. However, since the height of half-pint cartons is less than that of one-third quarts the second layer must be placed in the case at a different level than the second layer would be when casing either one-third quarts or pints. As noted before the level is determined by the length of stroke of the vertical ram 76 which is controlled by the amount of time the timer switch to the solenoid valve 184 is held closed. Since the level of the second layer for half-pints is different from the level when casing any other size carton, we use another timer switch 196 in circuit with solenoid valve 184 and the half-pint setting of selector switch 125. The timer cam for switch 196 is set to hold switch 196 closed, and thus maintain the solenoid valve 184 energized for the proper length of time for ram 76 to place the second layer of pints at the proper level. Similarly, a timer switch 198, in circuit with the solenoid valve 176, is held closed a proportional length of time to energize solenoid valve 176 and hold the cartons between plates 58 and 60 until ram 76 reaches the bottom of its stroke.

Similar to the casing of third-quart cartons, the second layer will be completed and lowered into the case after the fourth row of cartons are grouped. However, when stepping switch 148 reaches the eighth contact point, the half-pint setting of selector switch 125 will prevent the circuit to the CR3 coil 138 from being completed even though the timing switch 190 is closed at the end of the

timer cycle. This prevents the stepping switch 148 from being homed and also prevents the circuit to the case stop solenoid valve 136 from being completed thereby keeping the case stop frames 88 in the raised position.

The casing operation for half-pints will continue until the eleventh contact point is reached after the third row of cartons of the third layer is pushed into the carton grouping station 18. Stepper banks No. 3 and No. 4 will complete circuits to energize CR2 coil 162, and through timer switches 192 and 194 circuits will be completed at the proper time to pressure plate solenoid valve 176 and vertical ram solenoid valve 184, respectively. Also, through stepper bank No. 3 the circuit to CR3 coil 138 will be completed when the timer switch 190 closes near the end of the timer cycle. As before, when CR3 coil 138 is energized, the stepping switch 148 will be homed in preparation for a new casing cycle and the case stop solenoid valve 136 will be energized lowering the case stop frames 88 to discharge the filled case.

FIG. 8 of the drawings is a chart which illustrates graphically the time relationships of the opening and closing of the ten timer switches used in the circuit of FIG. 7. The bars in FIG. 8 show the periods of time that the switches are held closed by the timer cams. Of course, closing of the timer switches will complete only those circuits selected by the setting of the selector switch 125 and the contact point of the stepping switch 148. However, FIG. 8 should simplify understanding of the sequence of the various operations carried out by the caser. Note from FIG. 8 that the total time of one cycle (one ram revolution) is only six seconds. From this it is apparent that our novel caser can do a fast and efficient casing job.

From the above description of our caser it is apparent that an important part is the control circuit. This control circuit is almost fool-proof and extremely trouble-free. It makes the caser fully automatic regardless of continuous or intermittent feed of cartons and cases. If trouble should occur, the entire circuitry is contained in the control box 126 which can be readily removed and replaced in a matter of minutes thereby minimizing the down time for this machine. This is extremely important in the operation of dairy plants since the machines filling the cartons continuously feed them to the caser and would also have to be shut down if the caser stops for any length of time.

By making the various operations of the caser dependent upon time rather than sequence, our machine will continue to operate in spite of any "jamming" that may occur. In other words, it will clear itself and continue to operate regardless of a failure in a previous operation. Also, the use of the stepping switch and timer greatly reduces the cost since these functions were carried out in prior art casers by relatively complex and troublesome hydraulic, mechanical and electrical combinations.

Furthermore, since we have designed a machine using a relatively simple electrical control system combined with an air powered system to perform the actual movements, the machine is safe since the air pressures are low enough that accidental injuries to operators are practically eliminated.

Although description of our novel casing machine has been given in connection with standard size milk cartons and standard layering patterns used by the dairy industry, it is obvious that the flexibility accorded by the timer, stepping switch and selector switch permits an extremely wide variety of carton sizes, and layering patterns to be handled by our novel machine with only a few minor adjustments. It will therefore be appreciated that the descriptions are merely illustrative of the invention and are not to be construed as restrictive thereof. It is our intention that any revisions and variations of the invention as are reasonably expected on the part of those skilled in the art will be included within the scope of the following claims.

We claim:

1. A casing machine for placing containers supplied to said machine into open-top cases supplied to said machine at a level below the container supply line, said machine comprising case handling means for positioning and holding a case in the proper location to receive a group of containers, container support means movable to and retractable from a position over the open-top of a positioned case to support a group of containers when in position over the case, grouping means for forming a group of containers on said container support means, holding means for holding the formed group when the container support means is retracted from supporting position over the open-top of the positioned case, elevator means for lowering the group of containers into the positioned case, and an electrical control circuit for controlling the proper order and duration of operation of the various means of said machine, said electrical control circuit including a multiple-switch timer actuated in response to formation of a group of containers by said grouping means, each switch of said timer being held open and closed for a selected period of time, one of said timer switches being in circuit with the electrical control for each of the operating means of said machine to control the operation of each of the operating means of said machine independently.

2. The casing machine of claim 1 in which the grouping means include a reciprocable pusher that moves a selected number of containers onto the container support means each time said pusher advances, a first switch combined with said grouping means that opens and closes each time said pusher moves containers onto the container support means, and a stepping switch in said control circuit, said stepping switch having at least one bank of contact points engageable by a movable wiper, said wiper being advanced one contact point each time said first switch is opened and closed, said timer being actuated when the wiper of said stepping switch reaches a selected contact point.

3. The casing machine of claim 2 in which the control circuit includes a selector switch having a plurality of settings in circuit with certain of said timer switches and contact points of the stepping switch to provide for variation in the grouping of containers.

4. Casing machine of claim 3 in which the selector switch is in circuit with a plurality of timer switches that are in parallel circuits with the electrical control for said elevator means, each of said timer switches being held open and closed for different periods of time to provide for variation in the height to which a group of containers is lowered by the elevator means, selection of a particular timer switch being determined by the setting of said selector switch.

5. In a machine for placing containers fed to the machine into empty open-top cases supplied to the machine, said machine having means for supporting and grouping the containers and placing the grouped containers into an empty case, electrical control means for controlling the various operations of said machine, said control means including a multiple-switch timer and counter means actuated by said container grouping means, said counter means actuating said timer when the desired number of containers have been grouped, said timer switches being in circuit with the means for supporting and placing the grouped containers into the empty case thereby controlling these functions on a time basis and independent of each other.

6. In a casing machine for placing containers fed to the machine into empty open-top cases supplied to the machine, said machine having means for supporting and grouping the containers and placing the grouped containers into an empty case, the combination of fluid-operated means for powering the operations of the machine and electrical control means for controlling said operations in the proper sequence and for the necessary dura-

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tion, said electrical control means including counter means responsive to the container grouping means, and a multiple-switch timer actuated by said counter means to control the means for supporting and placing the containers into the case thereby providing for functioning of these operations on a time basis and independent of each other.

7. A casing machine for placing containers fed to the machine into empty open-top cases supplied to the machine at a level below the container feed line, said machine comprising case handling means for positioning and holding the case in a proper location to receive a group of containers, container support means movable to and retractable from a position over the open-top of the positioned case to support a group of containers when in position over the case, grouping means for forming a group of containers on said container support means, holding means for holding the formed group when the container supporting means is retracted from supporting position over the open-top of the positioned case, elevator means for lowering the group of containers into the positioned case, and means to guide the group of containers into the case, said case handling means including a first depending member connected to said container support means and retractable therewith to engage the inside edge of said case and thereby position said case when said support means is retracted.

8. The casing machine of claim 7 in which said case handling means also includes a second depending member fixed to said machine opposite the first depending member to engage the inside edge of said case opposite to that engaged by said first depending member.

9. The casing machine of claim 7 in which said first depending member is pivotally mounted on said container support means in such a way that it will pivot in one direction only, the bottom edge of said depending member swinging in the same direction that the support means moves when it is retracted.

10. The casing machine of claim 8 in which said first and second depending members are of a width slightly less than the width of the smallest case to be fed to said machine, whereby said members serve also to guide the containers into the case.

11. A casing machine having a casing station in which containers fed thereto are placed into empty open-top cases supplied to said machine at a level below the containers, said casing machine comprising first conveying means to supply cases to said casing station, second conveying means to supply containers to said casing station, casing means to group and place containers into a case during each casing cycle, means to raise a case into the cas-

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ing station, an electrical control circuit supplied by an electrical power source, first and second switches connected in said control circuit in parallel between the power source and main portion of said control circuit, said switches having first and second actuating members spaced apart so that both members will be simultaneously engaged by a case only when the case is in position to be engaged by the means to raise it into the casing station, the first actuating member being positioned to be engaged by the bottom of a case traveling on the first conveying means and the second actuating member being positioned to be engaged by the top of the case, the second actuating member preceding the first actuating member in the path of the moving case, and said control circuit being inoperative until activated by actuation of both of said switches.

12. A casing machine for placing containers fed to the machine into empty open-top cases supplied to the machine at a level below the container feed line, said machine comprising case handling means for positioning and holding a case in the proper location to receive a group of containers, container support means movable to and retractable from a position over the open top of the positioned case to support a group of containers when in position over the case, grouping means for forming a group of containers on said container supporting means, holding means including a pair of parallel, spaced apart, relatively movable plates that squeeze the formed group of containers when the container supporting means is retracted from the supporting position, elevator means for lowering the group of containers into the positioned case, and means to guide the group of containers into the case, said guide means including said plates, a first depending member connected to and retractable with said container support means to engage the inside edge of the case, and a second depending member fixed to said machine opposite to said first member to engage the inside edge of said case opposite to that engaged by said first member, said plates gripping said group of containers from the other side whereby said containers are guided into said case from all four sides.

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