July 5, 1966 P. J. SCHNEIDER 3,259,240

ELECTRICAL COMMAND STORAGE AND DISTRIBUTION SYSTEM

Filed Sept. 30, 1963 3 Sheets-Sheet 1

FIG. 1

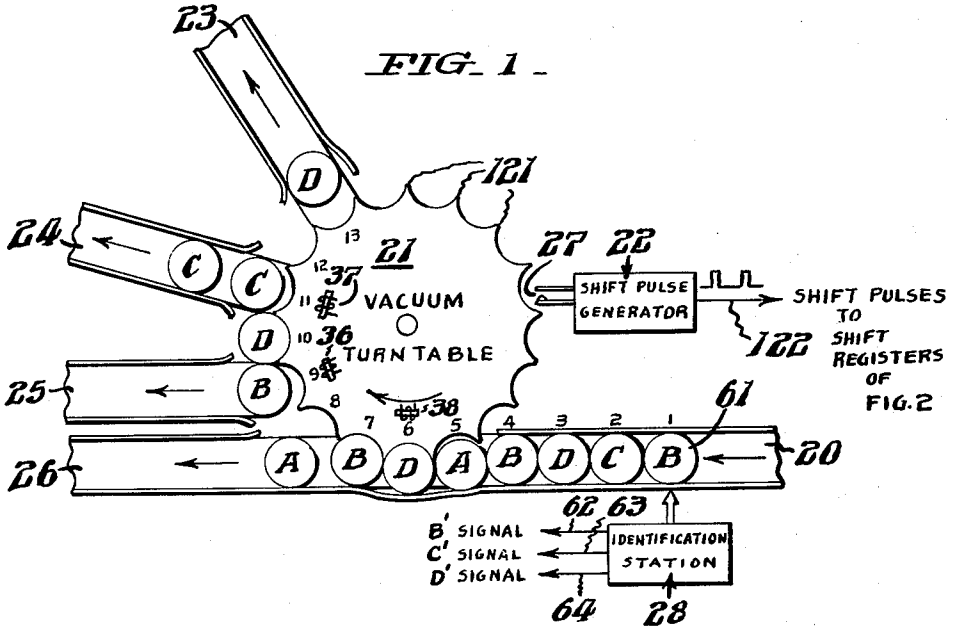
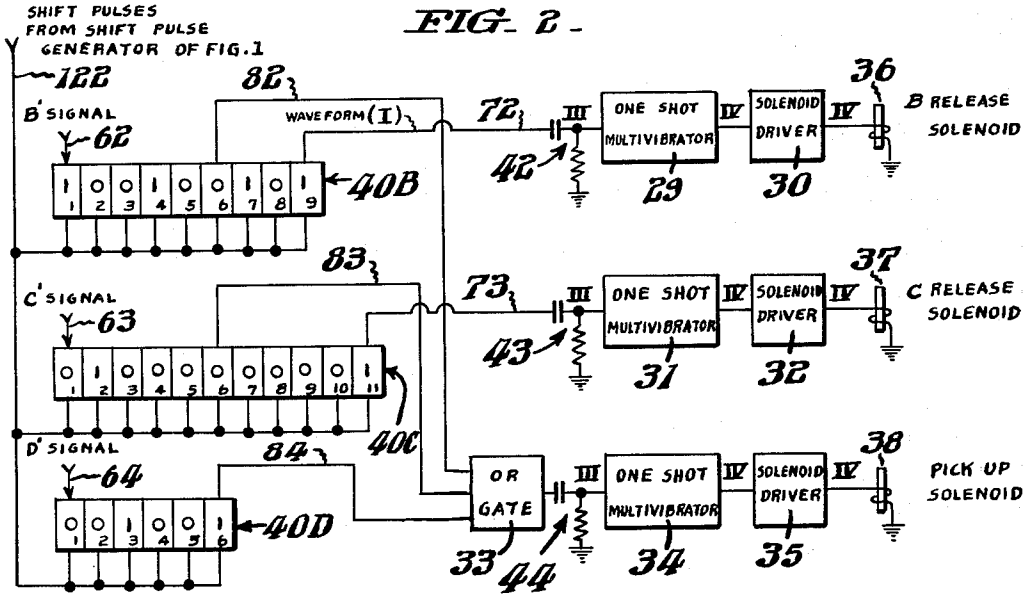


FIG. 2



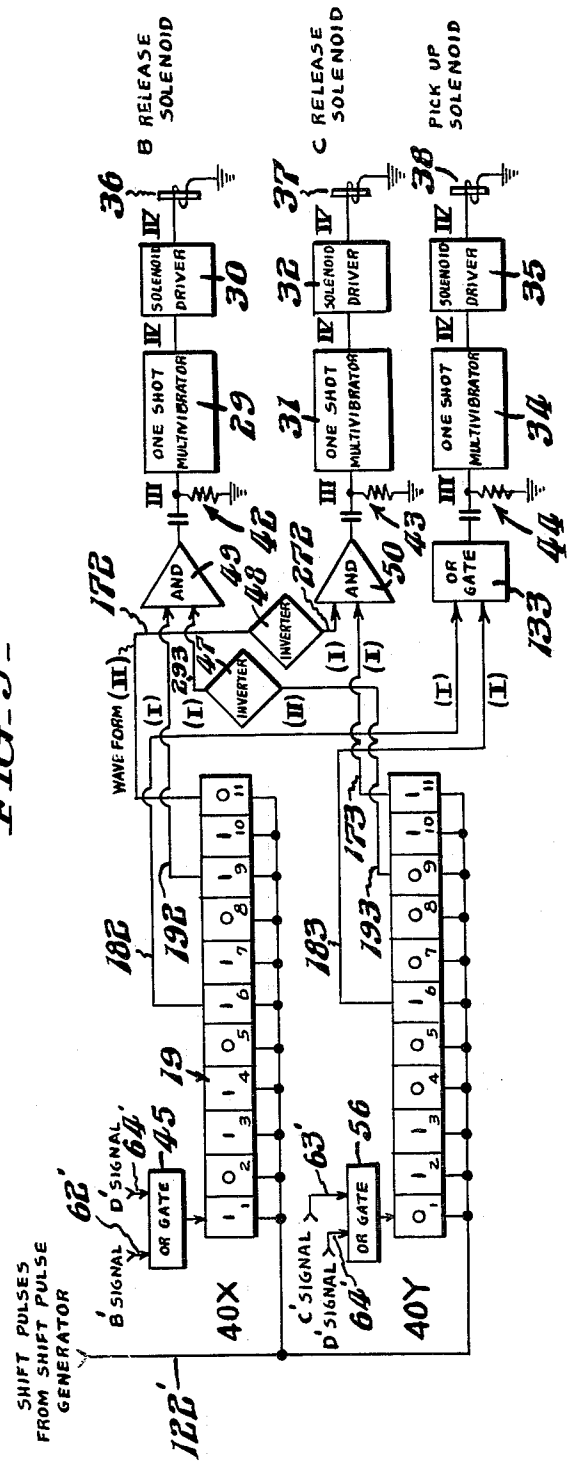
INVENTOR.
Paul J. Schneider,
BY
Paul & Paul
ATTORNEYS.

July 5, 1966 P. J. SCHNEIDER 3,259,240

ELECTRICAL COMMAND STORAGE AND DISTRIBUTION SYSTEM

Filed Sept. 30, 1963 3 Sheets-Sheet 2

FIG. 3



INVENTOR.
Paul J. Schneider,
BY
Paul & Paul
ATTORNEYS.

ELECTRICAL COMMAND STORAGE AND DISTRIBUTION SYSTEM

Filed Sept. 30, 1963 3 Sheets-Sheet 3

FIG. 4

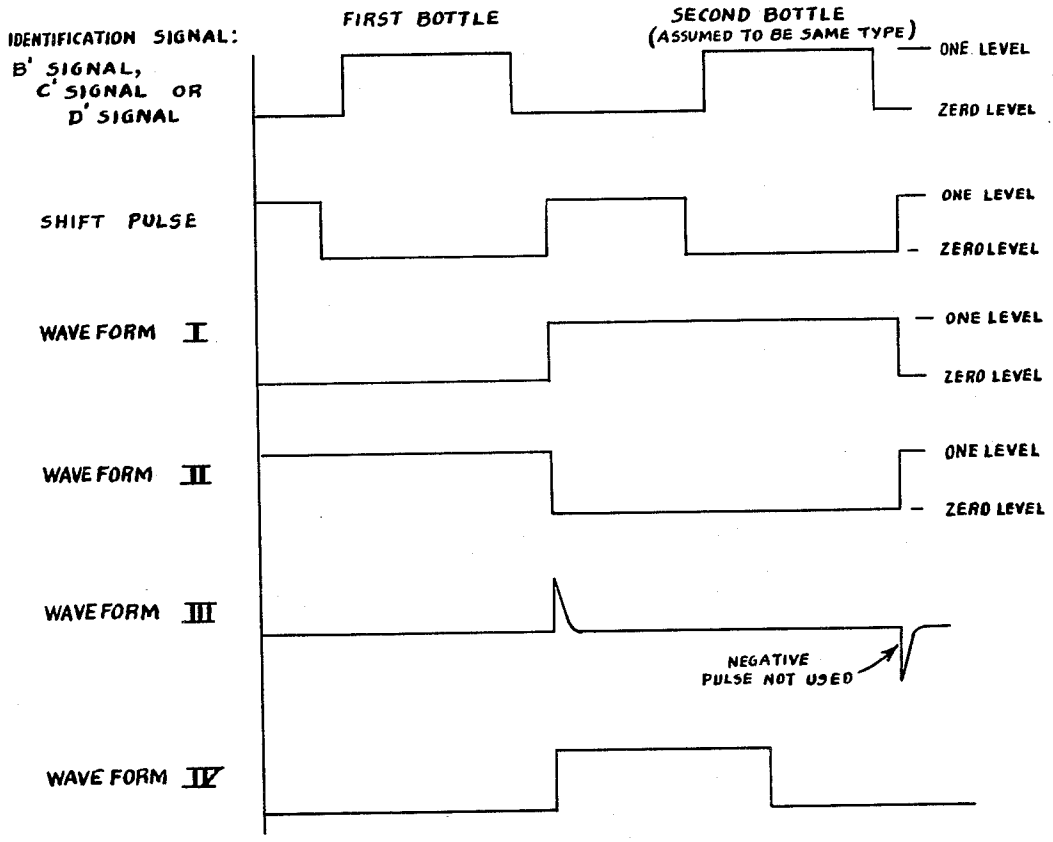


FIG. 5

BOTTLE TYPE	SHIFT REGISTER X	SHIFT REGISTER Y
A	0	0
B	1	0
C	0	1
D	1	1

INVENTOR.
Paul J. Schneider
BY
Paul & Paul
ATTORNEYS.

United States Patent Office 3,259,240 Patented July 5, 1966

3,259,240

ELECTRICAL COMMAND STORAGE AND DISTRIBUTION SYSTEM

Paul J. Schneider, 18 9th Ave., Haddon Heights, N.J.

Filed Sept. 30, 1963, Ser. No. 312,625
8 Claims. (Cl. 209—74)

This invention relates to apparatus for storing a multiplicity of electrical command signals and for delivering such command signals to their proper destination after an appropriate delay.

The apparatus of the present invention finds particular use in connection with automatic bottle sorting equipment, and the invention will be described as applying to such bottle sorting equipment. However, many other applications for the invention are possible, and will be apparent to those skilled.

The present invention will be clear from a consideration of the following detailed description of the invention as applied to bottle sorting equipment.

In the drawing:

FIG. 1 is a diagrammatic illustration showing a vacuum turntable as employed in automatic bottle sorting;

FIG. 2 is an electronic diagram illustrating a preferred form of control or command and storage circuitry for use in connection with the vacuum turntable of FIG. 1;

FIG. 3 is an electronic diagram illustrating an alternate form of circuitry;

FIG. 4 is a diagram showing wave forms employed in the system; and

FIG. 5 is a table which is useful in explaining the operation of the system.

Referring now to FIG. 1, vacuum turntable **21** is a known form of device equipped with suction cups capable of picking up and retaining a bottle (or other object) at station No. 6 on its star-like rim and of releasing the bottle, in response to an appropriate electrical command signal, at either station No. 9 or station No. 11 or station No. 13. It should be noted that in the present description the station numbers remain fixed in position, and that the pockets formed by the prongs of the turntable move through the stations. For example, station No. 9 is always at the head of conveyor **25**.

The bottle pickup mechanism, and also the release mechanism, are actuated by electrical solenoids in response to electrical command signals. The function of the vacuum turntable (which is a known device and not part of the present invention) is to direct bottles to a particular conveyor, such as conveyor **23**, or conveyor **24**, or conveyor **25**, or conveyor **26**.

As the vacuum turntable **21** is rotated, the prongs **121** of its star-like rim actuate in succession the switch **27** which is associated with the shift pulse generator **22**. Shift pulse generator **22** may be any one of a variety of known electrical circuits capable of generating a square pulse in response to the closing of the contacts of the switch **27**. Alternatively, in lieu of switch **27**, a light source, producing a beam of light which ordinarily falls upon a photosensitive device, but which is interrupted by the prongs **121** of the turntable, may be employed. Where a contact closure such as switch **27** is employed, care must be taken to insure that contact bounce does not occur, since closing of the contacts more than once for each actuation by a prong would cause more than one pulse to be generated, which would be undesirable. The square pulses developed by the shift pulse generator **22** appear on output lead **122** and are employed as shift pulses for the shift registers **40B**, **40C** and **40D** of FIG. 2.

The bottles **61** (or other containers) to be sorted are fed to the vacuum turntable **21** on the conveyor belt **20** and are carried away on one of the four conveyors **23**, **24**, **25**, or **26**, illustrated in FIG. 1. Each of the conveyors **20**, **23**, **24**, **25** and **26** are assumed to move in the direction indicated by the arrows in FIG. 1. The function of the conveyors is, of course, to transport the bottles. The conveyors per se form no part of the present invention.

In FIG. 1, the bottles **61** to be sorted are assumed to be of four different types, identified by the reference letters A, B, C, and D. Conveyor **20** carries the bottles past a recognition or identification station **28**. This station may be of a type shown and described in my co-pending patent application, entitled, "Bottle Recognition Apparatus," Serial Number 275,998, filed April 26, 1963. Identification station **28** forms no part of the present invention and may take any suitable form. In my co-pending patent application above referred to, the identification station employs a plurality of light beams and a plurality of associated light-responsive devices for generating electrical signals which are modulated in accordance with the light transmissive or light reflective characteristics of the different types of bottles passing through the beams. The equipment includes electronic comparator means for comparing the signals developed with other signals, such as reference signals, and for developing control recognition signals on the basis of such signal comparisons. Such control signals may then be used to control bottle sorting equipment.

The present invention is directed particularly to the method and means for utilizing the signals developed at the identification station **28** for controlling the operation of the bottle selecting equipment. In the drawing, identification station **28** is shown as developing, at any one time, one of three signals, identified as the B′ signal, the C′ signal and the D′ signal. The B′ signal is developed by a B type bottle, a C′ signal is developed by a C type bottle, and a D′ signal is developed by a D type bottle. In the system now being described, no signal is developed by the identification station **28** in response to an A type bottle passing through the station.

The B′ signal is developed at station **28** on lead **62** and is shown in FIG. 2 as being applied as an input signal to the first cell (cell No. 1) of the nine-cell shift register **40B**. The C′ signal is developed at station **28** on lead **63** and is shown in FIG. 2 as being applied as an input signal to the first cell (cell No. 1) of the 11-cell shift register **40C**. The D′ signal is developed at station **28** on lead **64** and is shown in FIG. 2 as being applied as an input signal to the first cell (cell No. 1) of the 6-cell shift register **40D**. The shift pulses developed on lead **122** by the shift pulse generator **22** of FIG. 1, are applied in parallel to the shift input circuits of each of the three shift registers **40B**, **40C** and **40D**. (Where the shift registers are magnetic core registers, the shift input circuits would be the shift windings.)

It will become clear as the description proceeds that the number of cells in each of the shift registers **40B**, **40C** and **40D** in FIG. 2, namely, 9 cells in register **40B**, 11 cells in register **40C**, and 6 cells in register **40D**, have a particular relationship to the stations or positions Nos. 9, 11 and 6 through which the pockets of the vacuum turntable **21** of FIG. 1 move. While the number of cells in the particular shift registers of FIG. 2 do have a particular application to the particular circuits being described, it will be understood that the particular number of cells in the shift registers shown is not to be considered a limitation to the broad teaching and scope of the invention now being described.

So far as the present invention is concerned, the cells of the shift registers **40B**, **40C** and **40D** may be of any known type, such as a magnetic core logic device having input, output and shift windings, or a bistable multivibrator or flip flop. Or, the cells may even be relays. In any event, each cell at any given time is in but one of

two stable states. These two states are commonly referred to as the "1" state and the "0" state. When a shift pulse is applied, each cell transfers its particular state to the next adjacent cell. All transfers take place in one direction only, i.e. from the lower numbered cell to the next higher numbered cell. Thus, in FIG. 2, the transfers in the shift registers shown are from left to right. The information signals B', C' and D' are inserted into the first cells of the respective shift registers on the shift register input leads **62**, **63** and **64**, and, thereafter, each time a shift pulse is applied to lead **122**, the information placed by the input signal into the first cell of the particular register is transferred along the register from left to right, as viewed in FIG. 2, moving along one cell for each shift pulse applied. The reset state of each cell is conventionally assumed to be the "0" state, and will be so assumed in the present explanation. The first cell is always reset to the "0" state by the application of the first shift pulse, which is immediately after the transfer of the information in the first cell to the second cell. Since the shift pulses on lead **122** are applied in parallel to all the cells of all three shift registers, **40B**, **40C** and **40D**, all cells of all three shift registers shift simultaneously. The manner of operation of a shift register is well known to those skilled in the art, and the foregoing remarks will be readily understood by those skilled.

In FIG. 2, the output from the last cell of each of the two shift registers **40B** and **40C** appears respectively on output leads **72** and **73** and is applied through a differentiating network **42** and **43**, respectively, to the one-shot multivibrators **29**, **31**, respectively. The output of the sixth cell of each of the three shift registers **40B**, **40C** and **40D** appears on leads **82**, **83** and **84**, respectively, and is applied to the OR gate **33** and thence through the differentiating network **44** to the one-shot multivibrator **34**. The function of the differentiating networks **42**, **43** and **44**, is to assure that pulses of short duration are applied to the one-shot multivibrators.

The one-shot multivibrators **29**, **31** and **34** may be any form of suitable known circuit which accepts short duration input pulses and produces a single output pulse of nominal preselected duration for each input pulse.

The outputs of the one-shot multivibrators **29**, **31** and **34**, are applied, respectively, to the solenoid driver circuits **30**, **32** and **35**, and the outputs of the solenoid driver circuits are applied, respectively, to the release solenoids **36**, **37** and pick up solenoid **38**.

The solenoid driver circuits **30**, **32** and **35** are known types of circuits which are capable of accepting a low power input pulse and amplifying such pulse to produce an output pulse of sufficient power to drive the solenoid.

The solenoid **36** in FIG. 2 is the release solenoid which controls the release of the B-type bottles from the pockets of the vacuum turntable **21**. When actuated, solenoid **36** causes the vacuum turntable **21** to release the bottle which it may be holding in the pocket at station No. 9 which in FIG. 1 is shown to be at the head of the conveyor belt **25**.

Solenoid **37** is the release solenoid for the C-type bottles. When actuated, solenoid **37** causes the vacuum turntable **21** to release any bottle which it may be holding in the pocket at station No. 11 which in FIG. 1 is at the head of the conveyor belt **24**.

Solenoid **38** is the pickup solenoid which when actuated causes the vacuum turntable **21** to take hold of any bottle which may be in the pocket at station No. 6 on the turntable, which in FIG. 1 is at terminal end of input conveyor **20**.

Referring again to FIG. 2, output leads are also taken from each cell No. 6 of each of the shift registers **40B**, **40C** and **40D**. These leads, identified as **82**, **83** and **84**, respectively, are connected to OR gate **33**. OR gate **33** is a known type of logic circuit which produces an output in response to an input signal on any one or more of its input lines, identified in FIG. 2 as lines **82**, **83** and **84**.

Operation

The bottles **61** (or other containers) to be recognized and sorted are moved along on conveyor **20**, from right to left as viewed in FIG. 1. Four types of bottles **61** are illustrated, identified as A, B, C and D. As these bottles move along on the conveyor **20**, they pass one by one through the identification station **28**, which in a typical case may direct at least one, and usually a plurality of, light beams across the belt to be intercepted by selected portions of the bottles as they pass by. Each type of bottle, other than type A, causes a signal to be developed on one of the three output leads **62**, **63** and **64** of the identification station. The B-type bottle develops a signal on the B' signal lead **62**. The C-type bottle develops a signal on the C' signal lead **63**, and the D-type bottle develops a signal on the D' signal lead **64**. The A-type bottle develops no signal on any of the output leads of the identification station **28**. An ideal waveform for each output signal developed by the identification station **28** is illustrated in FIG. 4. It will be seen to be a pulse.

In FIG. 1, the particular bottle being inspected at the identification station **28** is indicated as being a B-type bottle. Thus, a pulse signal will be developed on the B' signal lead **62** and applied to the input of the first cell of the shift register **40B**. This input signal places the first cell in the "1" state. The first cells of the other two shift registers **40C** and **40D** remain in the reset or "0" state, into which they were placed by the preceding shift pulse.

As the bottles **61** move onward, from right to left in FIG. 1, towards the vacuum turntable **21**, the tangential pressure imposed by the bottles on the prongs of the free wheeling turntable causes the turntable **21** to move rotationally, in synchronism with the motion of the bottles. It is to be noted that the turntable **21** is not positively driven; it is driven only by the pressure exerted tangentially upon its star-like rim by the movement of the bottles on the conveyor **20**.

Rotation of the vacuum turntable **21** causes one of its prongs **121** to close the switch contacts of switch **27**. This causes shift pulse generator **22** to develop a shift pulse which is applied by way of lead **122** to the shift windings or other shift circuits of each of the cells of all three of the shift registers **40B**, **40C** and **40D**. It is to be noted that the switch **27** is so physically located relative to the angular positions of the prongs **121** that the shift pulse is generated after the identification signal has been generated by the station **28** and before the generation of the next identification signal by the next bottle.

The application of a shift pulse to each of the shift registers causes the information stored in each of the cells to be transferred to the next adjacent cell to the right. Thus in FIG. 2, the "1" which has just been placed in the first cell of register **40B** by the B' indentification signal produced by the bottle B at station No. 1 in FIG. 1, is now transferred to the second cell of register **40B**. Simultaneously, the "1" which was in the second cell of the shift register **40C**, as the result of the generation of a C' signal by the C bottle, now at station No. 2 in FIG. 1, is transferred to the third cell of register **40C**. In like manner, the "1" which was in the shift register **40D**, as the result of the D' signal generated by the D bottle, now at station No. 3 in FIG. 1, is transferred from the third to the fourth cell of register **40D**. Thus, as the bottles are moved forward by the conveyor **20**, identification signals and shift pulse signals are successively generated, provided the bottles are of either the B, C or D type. As previously indicated, the A type bottle generates no identification signal.

It follows from what has just been said in the present illustrative discussion, that in the B shift register **40B**, the cells 1, 4, 7 and 9 will be in the one state, corresponding to B type bottles being at stations Nos. 1, 4, 7 and 9 in FIG. 1. Similarly, cells 2 and 11 of the C register **40C**

will be in the "1" state, corresponding to C type bottles being at stations Nos. 2 and 11 in FIG. 1. In like manner, the cells 3 and 6 of the D shift register 40D will be in the "1" state, corresponding to the D type bottles at stations Nos. 3 and 6 in FIG. 1.

Referring again to FIG. 1, the vacuum cup (not shown) at station No. 6 of the turntable 21 must be energized if the bottle at that station is to be retained and held by the turntable. If the vacuum cup at station No. 6 is not energized, the bottle will merely drop off at station No. 7 and be conducted away by the conveyor belt 26. It will be seen then that the vacuum cup at station No. 6 should be energized if the bottle at that position is either a B, C or D type bottle, since these types of bottles are intended to pass on to conveyors beyond conveyor 26.

In FIG. 2, the state of cell 6 of each of the shift registers 40B, 40C and 40D provides the necessary information regarding the type of bottle which is at station No. 6. In FIG. 2, the states of the sixth cell of the three shift registers tells us that there is a D bottle at station No. 6 of the turntable, since the sixth cell of register 40D is in the "1" state.

In FIG. 2, output leads 82, 83 and 84 are taken from each of the three sixth cells and connected to the input of OR gate 33. The output of OR gate 33 is applied through a differentiating network 44 to the one-shot multivibrator 34. Thus, in FIG. 2, in response to the shift pulse generated in shift pulse generator 22 following identification of the bottle B at station No. 1 in FIG. 1, an output pulse is developed on lead 84, passed through OR gate 33, differentiated in network 44, and applied to the one-shot multivibrator 34. The output of multivibrator 34 is a pulse of desired duration to drive the solenoid driver 35, thereby actuating the pickup solenoid 38 which is located at station No. 6 on the vacuum turntable 21.

In FIG. 4, ideal waveforms are shown for the identification signals, the shift pulses, the pulse output from the shift registers of FIG. 1 (waveform I), the short duration pulse or spike developed by the differentiating networks (waveform III), and the waveforms of the output pulses from the one-shot multivibrators and the solenoid drivers (waveform IV). Waveform II of FIG. 4 is related to the system of FIG. 3, later to be described.

It should be noted at this point that if the shift registers are of the magnetic core type, the output pulse developed at the last cells of the shift registers will be pulses, rather than merely a change of level, and in such case the differentiating networks 42, 43 and 44 may be omitted. Where, however, the cells of the shift registers are, for example, a transistor form of flip flop, the output is merely a change in voltage or current level, and the differentiating networks 42, 43 and 44 are desirable in order to produce a short duration pulse for application to the one-shot multivibrator. In the typical case, the short duration input pulse received by the one-shot multivibrator 29, 31 or 34, will produce an output pulse whose duration may be of the order of sixty milliseconds, as indicated by waveform IV in FIG. 4. The actual pulse length desired for application to the solenoid depends upon the speed at which the conveyor system is operating and the electromechanical characteristics of the particular pickup solenoid employed.

In the present discussion, a D type bottle is assumed to be at station No. 6 of the turntable 21, as a result of which an output pulse is delivered from shift register 40D and applied via lead 84, the OR gate 33, the differentiating network 44, and the one-shot multivibrator 34 to the solenoid driver 35 which delivers an amplified pulse to the pickup solenoid 38 which is sufficient to actuate momentarily this solenoid. This pickup solenoid 38 is located at station No. 6 on the vacuum turntable 21. Actuation of solenoid 38 causes a suction cup at station No. 6 to grasp the particular bottle then in the pocket at that position and to hold it as the turntable is rotated, thus carrying the bottle past conveyor 26.

It will be understood from the previous description and from the circuit shown in FIG. 2, that to actuate the pickup solenoid 38, the bottle at station No. 6 need not be a D type bottle. It may be either a B or C or D type. If the bottle at station No. 6 is any one of these three types, a pulse will be applied to the one-shot multivibrator 34 through the OR gate 33 and the solenoid driver 35 will drive the pickup solenoid 38. Thus, any bottle which is not an A type bottle will be picked up at station No. 6 and carried by the turntable past conveyor 26.

If an A type bottle happens to be at station No. 6, then the sixth cell of each of the three shift registers 40B, 40C and 40D will be in the "0" state, and no pulse will be developed on the leads 82, 83 and 84. Thus, the pickup solenoid 38 will not be actuated, and no vacuum will be applied to the suction cup at station No. 6 of the turntable 21. Thus, the A type bottle will not be picked up and held, and will be carried away by the conveyor 26.

It has been described above that if the bottle at station No. 6 of turntable 21 is either a B, C or D type, such bottle is picked up and carried by the turntable. It will be seen that if the bottle is a B type it should be released at station No. 9. This is accomplished in the system now being described by the fact that when the bottle B is at station No. 9, the ninth cell of the B shift register 40B, will be in the "1" state, and the next shift pulse will, in shifting the ninth cell back to the "0" state, develop an output signal which is applied through the differentiating network 42 to the one-shot multivibrator 29, the output of which will drive the solenoid driver 30 and actuate the B release solenoid 36. This solenoid 36 is located at station No. 9 on the vacuum turntable 21 and causes the vacuum to the vacuum cup to be cut off, thereby releasing the bottle B and permitting it to be carried away by the conveyor belt 25. The bottle B is assisted in leaving the turntable 21, when released, by the small amount of centrifugal force developed by the rotation of the turntable and by the camming action of the prong 121 of the rim of the star-wheel.

In like manner, when a C type bottle is at station No. 11 on the vacuum turntable 21, the eleventh cell of the C shift register 40C will be in the "1" state, as previously described, and the following shift pulse will develop an output signal from the eleventh cell which will be differentiated in the differentiating network 43 to actuate the one-shot multivibrator 31 and drive the solenoid driver 32 which will actuate the C release solenoid 37. This C release solenoid 37 is located at station No. 11 and functions to cut off the vacuum to the suction cup, thereby releasing the C type bottle and allowing it to be carried away by the conveyor belt 24.

Thus, only D type bottles will be carried beyond station No. 11 on the vacuum turntable 21. As the bottles which pass station No. 11 reach station No. 13, the vacuum may be conveniently released by mechanical means, thereby allowing the D bottles to be carried away by the conveyor belt 23. It will be understood that at station No. 13 no selection is required and that the vacuum is released from each vacuum cup as it passes station No. 13.

An alternate arrangement for accomplishing the same results as are accomplished by the circuitry of FIG. 2, is illustrated in FIG. 3. In FIG. 3, the circuitry to the right of and including the differentiating networks 42, 43 and 44, is identical to that of FIG. 2 and the components are identified by the same numerals as used in FIG. 2.

In the alternate arrangement, shown in FIG. 3, only two shift registers are used, identified as register 40X and register 40Y. The seperate register for the D' signal is eliminated, and the D' signal is applied to both the 40X and 40Y registers through OR gates 45 and 56, respectively. Each of the registers 40X and 40Y contains 11 cells. Each of the OR gates 45 and 56, which may be

of the same type as OR gate 33 of FIG. 2, will produce an output signal provided an input signal is present on either one or both of their respective input lines.

In FIG. 3, the input leads 62', 63' and 64' of the OR gates 45 and 56 are connected to the output leads 62, 63 and 64, respectively, of the identification station 28 of FIG. 1, and shift pulse lead 122' of FIG. 3 is connected to the output lead 122 of the shift pulse generator 22 of FIG. 1.

In FIG. 3, inverters 47 and 48 are employed. These are known forms of circuits for producing an output signal having the opposite logical sense from that of the input signal applied thereto. That is to say, if the input lead to the inverter is at a level corresponding to the logical "1," then the output lead from the inverter will be at a level corresponding to logical "0," and vice versa.

The AND gates 49 and 50 are known forms of circuits which produce an output signal only during that time interval when there is present on both of its input leads a signal level corresponding to the logical "1" level.

The operation of the system of FIG. 3 is as follows:

The first cell of shift register 40X will be set to a "1" state whenever a B' signal or a D' signal is generated by the identification station 28 of FIG. 1, and applied to the OR gate 45 through the leads 62' and 64'. The "1" state of the first cell will be shifted one cell to the right each time the bottles on the input conveyor 20 move forward one unit, thereby rotating the turntable 21 one pocket. Accordingly, if at any station along conveyor 20 and vacuum turntable 21, from identification station No. 1 up to and including station No. 11, either a B type bottle or a D type bottle is present, the correspondingly numbered cell of shift register 40X will be in the "1" state.

Similarly, the first cell of the shift register 40Y will be set to a "1" state whenever either a C' signal or a D' signal is generated by the identification station 28 and applied to the first cell through the OR gate 56 by way to the leads 63' and 64'. Accordingly, if any station along conveyor 20 or vacuum turntable 21 from station No. 1 to station No. 11 is occupied by either a C type bottle or a D type bottle, the correspondingly numbered cell of shift register 40Y will be in a "1" state.

Thus, in the present exemplary discussion, the shift register 40X has the first, third, fourth, sixth, seventh, ninth and tenth cells in the "1" state, corresponding to either a B or a D type bottle at stations Nos. 1, 3, 4, 6, 7, 9 and 10 of FIG. 1. Shift register 40Y has its second, third, sixth, tenth and eleventh cells in the "1" state, corresponding to either a C or a D type bottle at stations Nos. 2, 3, 6, 10 and 11 of FIG. 1.

The state of any two correspondingly numbered cells of shift registers 40X and 40Y will identify the type of bottle at the station of FIG. 1 bearing a corresponding number. This will be clear from a consideration of the tabulation shown in FIG. 5. As indicated in FIG. 5, if the bottle at any particular station of FIG. 1 is an A type bottle, both cells of shift registers 40X and 40Y having a corresponding number to that of the station, will be in a "0" state. If the bottle at the particular station is a B type bottle, the corresponding cell in shift register 40X will be in the "1" state while the corresponding cell in the 40Y register will be in a "0" state. If the bottle at the particular station is a C type bottle, the corresponding cell in the 40X shift register will be in the "0" state while the corresponding cell in the 40Y register will be in the "1" state. If the bottle at the particular station is a D type bottle, both cells bearing numbers corresponding to the station position will be in the "1" state.

To summarize, any station number in FIG. 1 may be occupied by any one of four bottle types, A, B, C or D, and the correspondingly numbered cells of the shift registers 40X and 40Y taken as a pair, may have any one of four combinations of states. These combinations are shown in tabular form in FIG. 5.

Consider now station No. 6 of FIG. 1. It will be recalled from the description given previously hereinabove of FIGS. 1 and 2, that if the bottle at station No. 6 is an A type bottle, the pickup solenoid 38 should not be energized, thereby allowing the bottle to be released from the turntable onto the conveyor 26. On the other hand, if the bottle at station No. 6 is either a B, C, or D type bottle, then the pickup solenoid 38 should be energized to retain the bottle in the pocket of the turntable 21.

It will be understood from what has already been said concerning FIGS. 3 and 5, that if the bottle at station No. 6 is an A type bottle, the sixth cell of both the 40X and 40Y shift registers will be in a "0" state, and in response to the following shift pulse (applied through lead 122') no output pulse will be developed on either of the sixth cell output leads 182 or 183, and no pulse will be applied to OR gate 133. Thus, the pickup solenoid 38 will not be energized.

On the other hand, if the bottle at station No. 6 is either a B, C or D type, it will be seen from the table in FIG. 5, that the sixth cell of at least one of the shift registers 40X and 40Y will be in the "1" state, and in response to the shift pulse an output pulse will be delivered on either one or both of the sixth cell output lead 182, 183, and this (these) pulse(s) will be applied to the OR gate 133 and an output pulse or level change will occur, the leading edge of which will be differentiated by network 44 and applied to the one-shot multivibrator 34 and solenoid driver 35 to actuate the pickup solenoid 38. Thus, the B, C or D type bottle will be retained in the pocket of the vacuum turntable 21 and the bottle will be carried beyond stations Nos. 6, 7 and 8 and into at least station No. 9.

If the bottle is a B type bottle it is desired that it be released at station No. 9, and the system of FIG. 3 will effect such a release. Reference to FIG. 5 will show that if the bottle is a B type bottle, the correspondingly numbered cell in shift register 40X will be in the "1" state while the correspondingly numbered cell in the 40Y register will be in the "0" state. In FIG. 1, a B type bottle is shown at station No. 9 and the ninth cell of the 40X register is accordingly shown to be in the "1" state while the ninth cell of the 40Y register is accordingly shown to be in the "1" state while the ninth cell of the 40Y register is shown to be in the "0" state. In response to the succeeding shift pulse which resets the ninth cell of the 40X and 40Y shift registers, the output lead 192 from the ninth cell of the 40X register will change to the "1" level, but the output lead 193 from the ninth cell of the 40Y register will remain at the "0" level. Inverter 47, however, converts the "0" level input from lead 193 into a "1" level output on lead 293. Thus, both of the input lines 192 and 293 to AND gate 49 will be at the "1" level, and, accordingly, the output from the AND gate 49 will change to the "1" level. The leading edge of this level change will be differentiated by the network 42 and applied to the one-shot multivibrator 29 and solenoid driver 30 to actuate the B release solenoid 36. In this manner, the B bottle will be released from station No. 9 on to the conveyor 25.

It should be noted that if the shift register cells are flip-flop circuits, it is not necessary to use the separate inverters 47 and 48. In lieu of using the inverters 47 and 48, the output connection 193 from the ninth cell of the 40Y register (and also connection 172 from the eleventh cell of the 40X register) can be made from the reset or "0" output terminal of the flip-flop of these cells.

In a generally similar manner, a C type bottle will be released from station No. 11 of the vacuum turntable 21. When the bottle is a C type bottle, the cells in the 40X and 40Y shift registers corresponding to the number of the station position are in a "0" and "1"

state, respectively, as indicated in FIG. 5. The output lead **172** from the eleventh cell of the 40X register is connected to the inverter 48 and the output lead **272** of the inverter is applied to the AND gate **50**. The output lead **173** from the eleventh cell of the 40Y register is also applied to the AND gate **50**. Accordingly, when the eleventh cells of the 40X and 40Y registers are in a "0" and "1" state, respectively, both inputs to the AND gate **50** change to the "1" level in response to the shift pulse, and the output lead from the AND gate **50** changes to the "1" level. This change in output level is differentiated in network **43** and applied through the one-shot multivibrator **31** and solenoid driver **32** to the C release solenoid **37**. In this manner, the C bottle is released from station No. 11 of the turntable **21** onto the conveyor belt **24**.

It has been described how the A bottles are released at station No. 6 onto the conveyor **26**, how the B bottles are released at station No. 9 onto the conveyor **25**, and how the C bottles are released at station No. 11 onto the conveyor **24**. Accordingly, only D type bottles pass on to the stations **12** and **13**, and, as has been indicated in connection with the description of FIG. 2, all bottles may be mechanically released at station No. 13 on to conveyor **23**.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed.

Having described my invention, I claim:

1. In a system for sorting different types of unit articles; an identification station; input means for conveying different types of unit articles through the identification station for developing different identification signals according to the different types of articles; means for conveying said articles in unit steps away from said identification station along a main path; a plurality of branch exit paths at different junction points along said main path; means for developing unit electrical pulses having a timed relation to the movement of said articles through said identification station and along said main path; a plurality of electronic multi-cell shift registers each having the same number of unit cells, said number of cells corresponding to the number of steps along said main path between said identification station and one of the junctions of said branch exit paths with said main path; means for applying different identification signals to different shift registers as an input information signal; means for applying said developed unit pulses to said shift registers in parallel as shift pulses to shift the information signals through said registers in timed relation to the movement of said articles through said identification station and along said main path; means for taking output signals from different cells of said shift registers having cell positions in said registers corresponding to the step locations of the junctions of different branch exit paths along said main path; control means at the junction locations of said branch exit paths for controlling selectively the continued movement of said article along said main path or its divergence into the branch exit path; and means for applying output signals from said shift registers to said junction control means for controlling the continued movement of said article along said main path or its divergence into said branch path.

2. Apparatus according to claim **1** characterized in that said means for taking output signals includes means connected to the last cell of each shift register and also means connected to a plurality of preceding cells in each register correspondingly numbered corresponding to the step locations of branch exit paths.

3. Apparatus according to claim **1** characterized in that said means for conveying said articles in unit steps away from said identification station along a main path comprises a vacuum turntable having pockets on its periphery, and in that said main path is defined by the peripheral pockets of said turntable.

4. Apparatus according to claim **3** further characterized in that said branch exit paths comprise conveyors leading away from the turntable periphery at different angular locations.

5. Apparatus according to claim **4** further characterized in that the periphery of said turntable includes protruding prongs at equal spacings and in that said means for developing unit electrical pulses having a timed relation to the movement of said articles through said identification station and along said main path includes switch means actuated by said protruding prongs.

6. Apparatus as claimed in claim **5** further characterized in that said control means at the junction locations of said branch exit paths includes an electrically actuable solenoid.

7. Apparatus as claimed in claim **6** further characterized in that said means for applying output signals from said shift registers to said junction control means includes a differentiating network and a one-shot multivibrator.

8. In a system for sorting different types of unit articles; an identification station, input means for conveying different types of unit articles through the identification station for developing different identification signals according to the different types of articles; means for conveying said articles in unit steps away from said identification station along a main path; a plurality of branch exit paths at different junction points along said main path; means for developing unit electrical pulses having a timed relation to the movement of said articles through said identification station and along said main path; a plurality of electronic multi-cell shift registers each having a different number of unit cells, each number of cells corresponding to the step location of the junction of a different one of said branch exit paths; means for applying different identification signals to different shift registers as an input information signal; means for applying said developed unit pulses to said shift registers in parallel as shift pulses to shift the information signals through said registers in timed relation to the movement of said articles through said identification station and along said main path; means for taking output signals from different cells of said shift registers having cell positions in said registers corresponding to the step locations of the junctions of different branch exit paths along said main path, said means for taking output signals including means connected to the last cell of each of said shift registers and also means connected to a preceding cell in each of said shift registers correspondingly numbered corresponding to the step location of the first of said branch exit paths; control means at the junction locations of said branch exit paths for controlling selectively the continued movement of said articles along said main path or its divergence into the branch exit path; and means for applying output signals from said shift registers to said junction control means for controlling the continued movement of said article along said main path or its divergence into said branch path.

References Cited by the Examiner

UNITED STATES PATENTS

2,664,197	12/1953	Pfister	209—72 X
2,990,965	7/1961	Smoll.	
3,070,227	12/1962	Larew.	

M. HENSON WOOD, JR., *Primary Examiner.*

ROBERT B. REEVES, *Examiner.*

J. N. ERLICH, *Assistant Examiner.*