A mail weighing and sorting machine directs mail in seriatim from a weighing station along segmented track portions of a main feed track. As each piece of mail is weighed a weight signal is delivered to a control circuit which is operative to cause a selected track segment to intercept the corresponding piece of mail as it travels along the main feed track. The control circuit includes a comparator which produces weight category signals from various stages thereof depending upon the weight of each piece of mail. Each computer output stage is connected to an associated delivery circuit. Each delivery circuit includes means for gating its various weight category signals to a corresponding actuator control, but some of the gated signals are delayed in a primary delay device which provides outputs to both the corresponding actuator control and an AND gate for gating a second weight category signal to a secondary delay device in the event the first delay device is already delaying a first weight category signal.

16 Claims, 3 Drawing Figures
SORTER CONTROL CIRCUIT

This invention relates to a control circuit and more particularly to a circuit for controlling a sorting machine of the type in which sorted articles are removed from selectively predetermined portions of a main feed track in accordance with control signals generated in response to various characteristics of each given article that is to be sorted. In this respect, however, the invention will be described in connection with a machine which sorts mail by weight. That is, a machine which weighs each piece of mail and then directs it along a main feed track for selective removal therefrom in accordance with the weight of each given piece of mail.

In sorting machines of the type noted above, the characteristics of the articles to be sorted are usually evaluated at a first station and signals representing each given article’s characteristics are delivered to a memory. The thusly evaluated articles are then moved along the main feed track until they reach selectively predetermined portions thereof where the given article is removed from the feed track in response to receipt of a signal from the memory. In connection with a mail-weighing sorting machine, for example, each given envelope is weighed and a representative signal of its weight is delivered to a memory. The given envelope is then moved along the feed track while subsequent envelopes are being weighed. The memory then delivers an actuating signal to a sorting station located along the feed track at the point in time when the given envelope is located at the sorting station. Hence, in a manner of speaking, the memory’s sorting signals to the various sorting stations are delayed by an amount corresponding to the weight of each given envelope.

One convenient manner of delaying such sorting signals is to deliver each envelope’s weight signal to a selected shift register corresponding to the envelope’s weight. Such shift registers, however, are relatively expensive. Hence, it is an object of this invention to provide a sorting machine control circuit that does not require the use of shift registers.

Shift registers and certain other types of presently available timing control circuits also have a tendency to be noise sensitive so that when used in a noisy atmosphere, their outputs tend to be erratic and unreliable. Consequently, it is another object of this invention to provide a sorting machine control circuit that is less noise sensitive than presently available sorting circuits.

Shift register circuits and other presently available timing control circuits are also required to have stringent timing requirements between the time given articles are initially delivered to the sorting machine and the time they are selectively removed therefrom. It is another object of this invention, therefore, to provide a control circuit that is adapted for use in a random feeding environment. In this regard, the control circuit of the invention permits a mail weighing machine, for example, to have the various pieces of mail fed thereto in a random manner.

One type of mail weighing and sorting machine uses a segmented main feed track wherein the main track segments are selectively pivoted upwardly at one end so as to intercept the various pieces of mail as they move along the track. The main track is then directed to secondary feed tracks which, in turn, are selectively actuated to direct given pieces of mail into one or another of a group of sorting bins. Any time a secondary track segment is actuated, therefore, its associated main track segment must also be actuated. Hence, it is still another object of this invention to provide a means for causing actuation of each main track segment whenever its associated secondary track is actuated.

The situation frequently arises in a segmented-track sorting machine where a particular track segment is being actuated at the same time that a second article is moving along the track to be intercepted at the same track segment. It becomes necessary, therefore, to interrupt the delivery of the second actuation signal to the particular track segment until after completion of the sorting step for the first such article. Consequently, it is more specific object of this invention to provide a circuit for interrupting the delivery of such subsequent actuation signals to a given track segment’s actuator until after completion of the given actuator’s prior operations.

SUMMARY OF THE INVENTION

In accordance with principles of the invention, signals representing characteristics of the articles to be sorted are delivered to a comparator which decodes the characteristic signals and, for each article to be sorted, delivers a sort or category signal to a selected one of a plurality of actuation control devices corresponding to the various categories into which the articles are to be sorted. One possible scheme of the means for delivering the category signals to the actuator control includes at least one primary delay device and one secondary delay device for use when the primary delay is in operation. Outputs from each of the delay devices (either primary or secondary) are then delivered to the associated actuator control so that each article is sorted in accordance with the category of its actuated control.

When the invention is applied to a segmented-track type of sorting machine, another aspect includes a means for insuring that each main track segment is actuated whenever a given secondary track receives a corresponding actuation signal.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention as illustrated in the accompanying drawings, wherein the same reference characters refer to the same parts throughout the various views. The drawings are not necessarily drawn to scale. Instead, they are merely presented so as to illustrate the principles of the invention in a clear manner.

FIG. 1 is a schematic pictorial view of a mail weighing and sorting machine in which the circuit of the invention is embodied;

FIG. 2 is a fragmentary schematic view taken along the lines 2—2 in FIG. 1; and,

FIG. 3 is a schematic diagram of a circuit of the invention.

The circuit of the invention is intended for use with sorting machines such as that illustrated in FIG. 1. In this respect, a mail weighing and sorting machine has an input where pieces of mail are placed serially, one at a time, either manually or by a suitable automatic feeding means not shown. Rollers 12 on the input station direct each piece of mail to a synchronizing station 14 represented by a synchronizing plate 16 that is vertically movable by a pneumatic actuator 18 (FIG. 2). In this respect, as each piece of mail is fed toward a random feeding environment (FIG. 2), disrupting the light beam and thereby sensing the presence of a piece of mail and, also delivering a signal representative thereof on line 22 to a control unit 26 as shown in FIG. 2.

When the photocell detects the presence of a piece of mail, a solenoid 27 receives a signal from the control unit 26 on line 28 to direct air pressure from a pneumatic supply 29 along line 30 to the pneumatic actuator 18 which moves the plate 16 downwardly. The given piece of mail, which has been aligned by the plate 16, is then passed onto a second set of rollers 31 located at a weighing station 32.

When the piece of mail is moved from over the photocell 20, the signal on line 22 changes and the control unit 26 directs a signal on line 28 for the solenoid 27 to remove air pressure from the pneumatic actuator 18 so that the plate 16 moves upwardly again to align a second piece of mail and prevent its passage onto the weighing station 32. At the same time, the control unit 26 delivers a signal on line 33 to a solenoid 34 which directs air from pneumatic supply 29 to a set of pneumatic actuators 38 and 40 which move the rollers 31 downwardly so that the given piece of mail rests on knife edges 44 of a scale assembly 45.

A first shaft 46 extends downwardly from the scale assembly into a dash pot 47; and a second shaft 48 extends downwardly...
from the scale assembly into a linear variable differential transformer (LVDT) 50. In this respect, one such structure that has been found to be satisfactory, provided a maximum downward travel of the shaft 48 (and knife edges 44) of about 0.280 inch and used an LVDT having an output range on line 52 to the circuit of FIG. 3 of about 0 to 10 volts; or about 560 to 580 millivolts per ounce of a given piece of mail placed on the knife edges 44.

By means of the above described structure, the magnitude of each signal delivered on line 52 to the sorter control circuit represents the weight of each given piece of mail placed on the knife edges 44. It will be appreciated by those skilled in the art, however, that when the sorter control circuit of the invention is used in a different environment the signals delivered thereto on line 52 might equally as well represent other pertinent signals of the coded articles such as their ZIP Codes, for example.

As will be described more fully shortly, the weight signals on line 52 are compared in a comparator 54 to reference signals from a multi-range reference voltage generator 56. Each input on line 52 is decoded by the comparator 54 to produce an output from a selected AND-gate A1 through A8 depending upon the main successively input weight signal on line 52. Outputs from these AND gates are then selectively delayed and delivered to the related actuation control means such as single-shots SS1-SS8, lines 55, and sorting station control solenoids CS1-CS8 in FIG. 2. When one of the sorting station control solenoids is thusly actuated by a signal from its associated single-shot, it is operative to direct air from a pneumatic supply manifold 60 to a corresponding sorting station actuator SA1-SA8.

Each of the sorting station actuators is connected to a pivotal track segment on one of four sorting stations 61-64 in FIG. 1. In this respect, sorting actuator SA1 is connected to a pivotal segment 71 on a main feed track which moves mail in the direction of arrow 65 in FIGS. 1 and 2. Similarly, sorting actuator SA2 is connected to a secondary track segment 72 for selectively pivoting the right end thereof upwardly into the position shown in FIG. 1. In the same manner, SA3 is connected so as to selectively actuate main track segment 73; SA4 selectively pivots secondary track segment 74 upwardly into the FIG. 1 position; output shaft 66 of SA5 selectively pivots main track segment 75 upwardly at its left end as illustrated in FIG. 1; SA6 selectively actuates secondary track segment 76; SA7 selectively actuates main track segment 77; and SA8 selectively actuates secondary track segment 78.

In operation, as each given piece of mail is weighed by the scale 45, the corresponding output signal from LVDT 50 is decoded; suitably delayed; and delivered to the proper sorter actuator just as the given piece of mail is about to pass onto the main track segment corresponding to the selected sorter actuator. In FIG. 1, for example, after a piece of mail is weighed at station 32, it is passed onto driving belts of the first main track segment 77 by the rollers 31. Just as the piece of mail is about to pass onto the driving belts of main track segment 75, however, SA5's actuator shaft 66 pivots the scale end of the main track segment 75 upwardly so that the particular piece of mail is permitted to drop onto a drive belt 80 of the secondary track segment 76 located directly beneath the main track segment 75. In this manner, the piece of mail is directed to the sorting FIG. 2 along the direction of either arrow 82 over a transparent shield 84 into a bin B6 if the secondary track segment 76 is moved into its upper position as shown; or along dotted arrow 86 into bin B5 if the secondary track segment 76 is left in its lower position.

The remaining main and secondary track segments are operated in the same manner as to selectively sort the various pieces of mail and place them in corresponding bins B1-B8 depending upon the weight of each given piece of mail. If, however, certain pieces of mail are "off-weight," none of the track segments are actuated so that the "off-weight" pieces of mail pass off of the end of the last main track segment 71 and into an "off-weight" bin 88.

One of the problems in connection with the above-described type of sorting structure is that of maintaining a high output speed. In this regard, a simple manner of operation would be to weigh each piece of mail; adjust the position of the desired main and secondary track segments in accordance with each given piece of mail's weight; direct the thusly weighted piece of mail along track 65 until it is deposited into the proper bin; and lower the synchronizing plate 16 to permit another piece of mail to be placed on the weighing station 32 so that the weighing and sorting operation could be performed on the second piece of mail.

It is far more desirable, however, to permit pieces of mail to be placed at the weighing station as rapidly as possible and then directed along the main track while preceding pieces of mail might not yet have arrived at their desired bins. As noted above, one way of accomplishing such an objective would be to deliver the weighing station's output to selected shift registers. Another would be to merely interpose simple delay lines between the weighing station's output and the various sorting station actuators. But the shift register solution has the drawbacks described above; and the simple delay line solution is not adequate because signals from the weighing station for many successively enveloped envelopes are delivered to either of bins B1 or B2, for example, would require the second envelope to be held up until the delay circuit was free to receive the weighing station's second output signal. These problems are solved by means of the FIG. 3 circuit which will now be described in more detail.

As previously described, the output signals from the LVDT are delivered on line 50 to each of 9 stages of a comparator 54. These signals are compared with a plurality of progressively increasing reference voltage signals delivered to the various comparator stages from the multi-range reference voltage generator 56 along cable 90. In this respect, assume that it is desired to sort mail into 1 ounce categories, within a low-weight range of up to 8 ounces. "Off-weight" bin B8 is then used to receive all mail weighing less than 1 ounce; bin B1 receives all mail weighing 1 ounce or more but less than 2 ounces; bin B2 receives mail weighing 2 or more ounces but less than 3 ounces; and so on until bin B8 receives all mail weighing 8 ounces or over. Under such circumstances, the reference voltage delivered to comparator stage 1 corresponds to the output signal generated by the LVDT for pieces of mail weighing between 1 and 2 ounces. Similarly, the reference voltage delivered to the second stage of the comparator 54 corresponds to the voltage generated by the LVDT for envelopes weighing between 2 and 3 ounces; and so on until the reference voltage delivered to the 8th stage of the comparator 54 corresponds to the voltage generated by the LVDT for mail weighing 8 ounces or over. The 9th comparator stage is biased out of the circuit when operating in the low-weight range.

As a piece of mail is being weighed, the LVDT's output increases until it reaches a voltage corresponding to the piece of mail's weight. Hence, each of the comparator's stages, produces an output on its corresponding output line 91 whenever the voltage on line 52 reaches or exceeds that of the reference voltage delivered to the stage on line 90. For example, if the piece of mail to be sorted weighs 6 ounces or more, but less than 7 ounces, it is desired that it ultimately be delivered to bin B6. Consequently, as the LVDT output signal increases, signals appear on output lines 91 for each of the first six stages of the comparator 54.

Each of the comparator stage output signals on lines 91-1 through 91-8 are delivered to three-way AND-gates A1 through A8 respectively. For reasons to be explained more fully shortly, the output from the 9th comparator stage is inverted in an inverter 18 and then delivered as a second input to three-way AND-gate A8; and except for the first comparator stage, each of the stage outputs are also delivered to a respective inverter, 11 through 17, whose output is delivered to the corresponding three-way AND-gate associated with the next lower comparator stage. The third inputs to the various three-
way AND-gates A1 to A8 are received from control 26 on a common line 92 at about the same time it delivers its signal on line 33 to the pneumatic actuators 38 and 40 for raising the rollers 34 (FIG. 2).

In operation, no more than one of the three-way AND gates produces an output in response to any given signal delivered to the comparator 54 on the line 52. In the case of the envelope to be deposited in bin B6, for example, as each of the comparator stages produces its output on line 91 for delivery to its associated three-way AND gate, the inverted output signal from the succeeding comparator stage is operative to "degate" the prior stage's three-way AND gate. In this manner, only the highest ordered comparator stage to produce an output in response to a signal on line 52 is permitted to produce a corresponding output from its AND gate. This output, from gate A6 in this example, is then delivered on line 93 to a delay device D6 which delays the A6 output for a period of time corresponding to that required for the 6 ounce envelope to travel from the weighing station to a point just prior to the main track segment 75. At this time, an output from D6 is provided on line 94 to singulators SS6 which, as noted above, energizes solenoid CSS6 which controls actuation of a sort actuator SA 6 to raise secondary track 76. Also, at the same time, the output from SS6 is delivered to SS5 for energizing solenoid CSS5 which directs pneumatic pressure to sort actuator SA5 which moves shaft 66 and main track segment 75 upward. In this manner, the particular piece of mail falls onto drive belt 80 of secondary feed track 76 when it leaves the driving belts of the first main track segment 77, and the driving belt 80 then propels the envelope over the transparent shield 84 and into bin B6.

When it is desired to place a given envelope in bin B5 the operation of the circuit is substantially the same as that described in connection with B6 except that no signal is delivered to SS6 so that secondary track segment 76 remains in its lower position and the envelope follows dotted arrow B6 into bin B5.

The operation of the sorting control circuit is also similar to that described above when it is desired to place given envelopes in bins B7 or B8. In these cases, however, there is no need to delay the output signals from the respective AND-gates A7 and A8. Also, when it is desired to place envelopes in bin B8, there is no need for a delay because none of the track segments are actuated.

The outputs from each of the three-way AND-gates A1 through A4 are delivered to primary delay devices D1-1 through D4-1, respectively, and respective supplemental two-way AND-gates 95, 96, 97, and which also receive inputs from those of the corresponding primary delays that are activated at any given time. Outputs from these supplemental AND-gates are delivered on lines 99, 100, 101 and 102, respectively, to second delay devices D1-2 through D4-2, also respectively. The outputs from the primary delay devices, D1-1, D2-1, D3-1, and D4-1, are delivered to respective single-shots, SS1, SS2, SS3, and SS4, which also receive outputs from respective secondary delay devices D1-2, D2-2, D3-2, and D4-2.

The two-way AND-gates 95-98 are received from the corresponding primary delay devices D1-1 through D4-1. In this manner, if one of the three-way AND-gates A1-A4 produces an output signal at a time that its corresponding primary delay device is already delaying a prior signal, the output on the three-way AND gate's combines with the output from the related primary delay to gate a signal through the corresponding two-way AND gate for delivery to that particular gate's secondary delay device. Again, as in the case of delay devices D5 and D6, the primary and secondary delay devices are operative to delay output signals to their corresponding single-shots for a period of time corresponding to that which it takes a given envelope to travel from the weighing station 32 to a point just prior to the main track segment associated with the bin into which the given envelope is to be deposited.

In summary of the above described operation of FIG. 3's sorter control circuit, envelopes to be delivered to bin B5 provides an LVDT output signal which, as it rises, sequentially provides an output from each of the first 8 stages of the comparator 54; and these outputs are delivered to corresponding three-way AND-gates A1-A8. The output signals from comparator stages 2 through 8, however, are inverted and delivered to the three-way AND gate corresponding to the preceding comparator stage so that only A8 provides an output upon receipt of the timing signal on line 92. The output from A8 is passed directly to SS8 which provides outputs to both SS7 and control solenoid CSS8 so that main track segment 77 and secondary track segment 78 are moved upwardly and the envelope is directed into bin B8. The circuit for an envelope to be delivered to bin B7 is similar except that SS8 delivers no output and secondary track 78 remains in its lower position.

The circuit's operation for envelopes to be delivered in bins B5 and B6 is similar to that described in connection with the deposit of an envelope in bins B7 and B8. Hence, this operation will not be further described.

Assume now that it is desired to deposit two successive envelopes in bin B1. In this event, the first envelope causes the LVDT's output to rise to a level such that only the first comparator stage provides an output. This output on line 91-1 is delivered to three-way AND-gate A1; and since the second comparator stage provided no output, A1 is not deputed by a signal on line 91-2. Hence, A1 provides an output on line 103 upon receipt of the next timing signal on line 92. The signal on line 103 is delivered to primary delay D1-1 when the first of the two envelopes leaves the weighing station 32.

After the first of the two envelopes leaves the weighing station 32, the synchronizing plate 16 moves downwardly and places the second envelope at the weighing station where it subsequently causes the LVDT to produce another signal on line 52 which, again, only energizes the first stage of the comparator 54. This output is delivered to A1 prior to the time the first envelope reaches the end of main track segment 73 at station 63. Hence, primary delay means D1-1 is still occupied with the signal it received in response to the first of the two envelopes; but the primary delay produces a signal on line 105 to the two-way AND-gate 95 at the same time AND-gate 95 receives its signal on line 106 from A1 in response to receipt of a timing signal on line 92.

Just as the first of the two envelopes is about to reach main track segment 71, the primary delay D1-1 produces a signal on line 104 to SS1 so that main track segment 71 is raised and secondary track segment 72 remains in its lowered position. Hence, the first envelope is directed into bin B1. Shortly thereafter, an output from the secondary delay means D1-2 is delivered on line 108 to SS1 for a secondary actuation of main gate 71. Hence, the second envelope is also directed into bin B1.

The remaining portions of the circuit of FIG. 3 operate in a similar manner to that which has been described above. Hence, they will not be further described. But, it will be appreciated by those skilled in the art that the above described structure provides a sorting machine control circuit that eliminates the use of shift registers and does not require the critical timing relationships that are usually associated with such shift registers. In addition, the above described circuit permits the use of simple delay devices which are not overly noise sensitive. Also, by means of the secondary delay devices D1-2 through D4-2 it is not necessary to wait for a first envelope to be deposited in its desired bin before delivery of a subsequent envelope onto the sorting track. Further, the described circuit permits a given envelope to be automatically actuated when its corresponding secondary track segment is similarly actuated. Hence, the foregoing structure fulfills the objectives of the invention.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it should be noted that various changes in form and detail may
be made therein without departing from the spirit and scope of the invention. For example, the reference voltage generator 56 has been provided with high and low ranges of reference voltages; and it is when the circuit is used in its high reference voltage range that the 9th comparator stage finds utility. For example, after bin B8 becomes filled, the reference voltage generator is switched into its high range so that envelopes weighing under 9 ounces are directed to bin B1; 10 ounce envelopes into B2; and so on until envelopes weighing between 15 and 16 ounces are directed into B8. Under these circumstances, however, there is no provision for envelopes weighing over 1 pound. Hence, the high range reference voltage to comparator stage 9 corresponds with LVDT output signals representing articles weighing more than 1 pound; and, after the various comparator stages have sequentially delivered their output signals to the three-way AND-gates A1–A8, the comparator's 9th stage delivers an output on line 91-9. That output signal is inverted in 18 and delivered to three-way AND-gate A8. Hence, A8 is degated; none of the three-way AND-gates provide any outputs; none of the various track segments are actuated; and the overweight envelope is permitted to traverse the entire length of the sort track so as to be delivered to "off-weight" bin B8.

Similarly, it will be appreciated by those skilled in the art that the various delay devices can be adjustable; and, where additional track segments are provided, tertiary and quarterly delay devices can be added to the various delays for the actuators corresponding to the track segments located furthest away from the weighing station. Also, although the circuit has been illustrated for use in connection with secondary track segments having only two positions, it will be appreciated that the circuit can be adapted for devices having more secondary track segments.

I claim:

1. A control circuit for an article sorting machine of the type in which articles falling within various categories of a given article characteristic are moved in seriatim along a main sorting track and selectively moved off of said sorting track so that articles in the same category are grouped together comprising:

   signal means for generating a category signal representing the category of each article;

   actuation control means corresponding to each of said categories for actuating an associated actuator; and,

   delivering means for delivering each category signal to the corresponding actuation control means, said delivering means including:

   first delay means connected to said signal means for delaying a first of said category signals in a given category; second delay means for delaying a second of said category signals in said given category; and,

   AND gating means connected to said signal means and to said first delay means for receiving signals from said signal means and said first delay means, said AND gating means also connected to said second delay means for gating said second category signal to said second delay means when said first delay means is delaying said first category signal.

2. Apparatus according to claim 1 wherein said actuation control means includes a single-shot for energizing a solenoid to control the corresponding actuator.

3. Apparatus according to claim 1 wherein said signal means for generating said category signal for representing the category of each given article includes:

   a comparator having a stage corresponding to each category signal, each of said stages adapted to produce an output signal therefrom representing its corresponding category; and,

   a plurality of gating means for gating the category signal corresponding to each given article to only the delivering means corresponding to each category signal.

4. Apparatus according to claim 3 wherein said actuation control means includes a single-shot for energizing a solenoid to control the corresponding actuator.

5. A control circuit for an article sorting machine of the type in which articles falling within various categories of a given article characteristic are moved in seriatim along a main sorting track and selectively moved off of said sorting track so that articles of the same category are grouped together comprising:

   signal means for generating a category signal representing the category of each given article, said signal means including:

   a comparator having a stage corresponding to each category signal, each of said stages adapted to produce an output signal therefrom representing its corresponding category; and, a plurality of gating means for gating the category signal corresponding to each given article only to a delivering means corresponding to that category signal, each of said plurality of gating means comprising a three-way AND gate requiring three inputs to provide an output, the first of said inputs being derived from a corresponding comparator stage, the second input being derived from the next higher comparator stage, and the third input being derived from a timing control;

   actuation control means corresponding to each of said categories for actuating an associated actuator; and,

   delivering means for delivering each category signal to the corresponding actuation control means, said delivering means including:

   first delay means connected to said signal means for delaying a first of said category signals in a given category; second delay means for delaying a second of said category signals in said given category when said first delay means is delaying said first category signal.

6. Apparatus according to claim 5 including an AND gate and wherein said second category signal is gated to said second delay means by said AND gate by a signal from said first delay means indicating that said first delay means is delaying said first category signal.

7. Apparatus according to claim 5 wherein said actuation control means includes a single-shot for energizing a solenoid to control the corresponding actuator.

8. Apparatus according to claim 5 including an AND gate and wherein said second category signal is gated to said second delay means by said AND gate by a signal from said first delay means indicating that said first delay means is delaying said first category signal.

9. Apparatus according to claim 5 wherein each of said comparator stages produces an output signal in response to the simultaneous receipt of two substantially equal input signals and including:

   means for generating a characteristic signal representing the characteristics of said article;

   means for generating a plurality of reference signals; and

   means for delivering said characteristic signal to each of said comparator stages; and,

   means for delivering selected reference signals to given comparator stages so that a given comparator stage provides an output when said characteristic signal and the selected reference signals are substantially equivalent.

10. Apparatus according to claim 9 including an AND gate and wherein said second category signal is gated to said second delay means by said AND gate by a signal from said first delay means indicating that said first delay means is delaying said first category signal.

11. Apparatus according to claim 9 wherein said actuation control means includes a single-shot for energizing a solenoid to control the corresponding actuator.

12. Apparatus according to claim 11 including an AND gate and wherein said second category signal is gated to said second delay means by said AND gate by a signal from said first delay means indicating that said first delay means is delaying said first category signal.

13. Apparatus according to claim 9 including means for selectively varying the reference signals to said comparator stages.
14. Apparatus according to claim 13 including an AND gate and wherein said second category signal is gated to said second delay means by said AND gate by a signal from said first delay means indicating that said first delay means is delaying said first category signal.

15. Apparatus according to claim 13 wherein said actuating control means includes a single-shot for energizing a solenoid to control the corresponding actuator.

16. Apparatus according to claim 15 including an AND gate and wherein said second category signal is gated to said second delay means by said AND gate by a signal from said first delay means indicating that said first delay means is delaying said first category signal.

* * * * *