

April 15, 1969

J. F. McGUIRE ET AL

3,439,281

APPARATUS FOR RANDOMLY CONTROLLING THE FLOW OF PULSES FROM
A PULSE SOURCE TO A PLURALITY OF OUTPUT LINES

Filed Dec. 8, 1966

Sheet 1 of 4

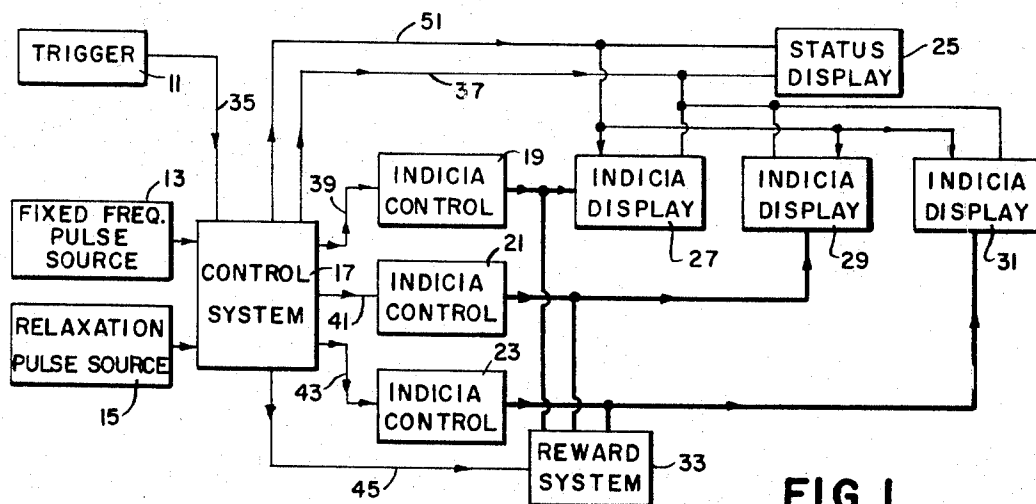


FIG. 1.

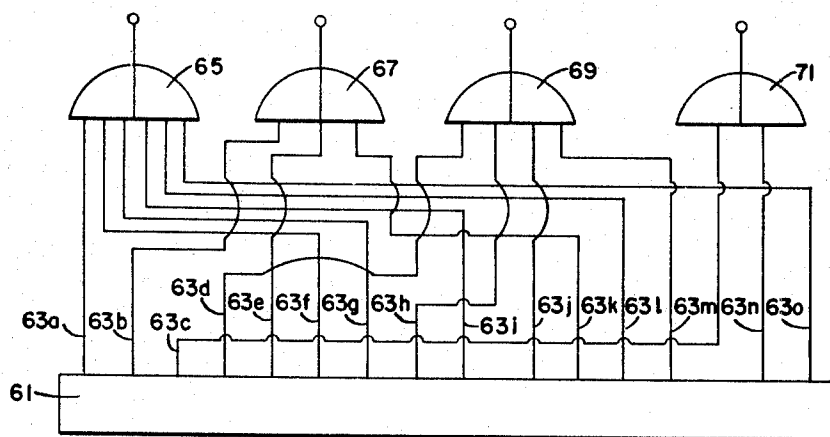


FIG. 4.

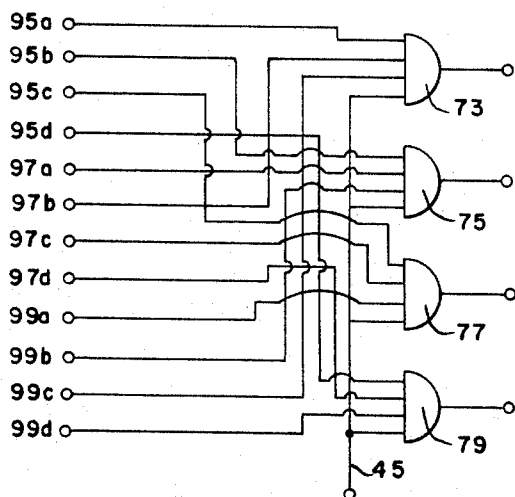


FIG. 5.

INVENTORS
James F. McGuire

Norman S. Babbitt

BY

Griffin & Brangan
ATTORNEYS

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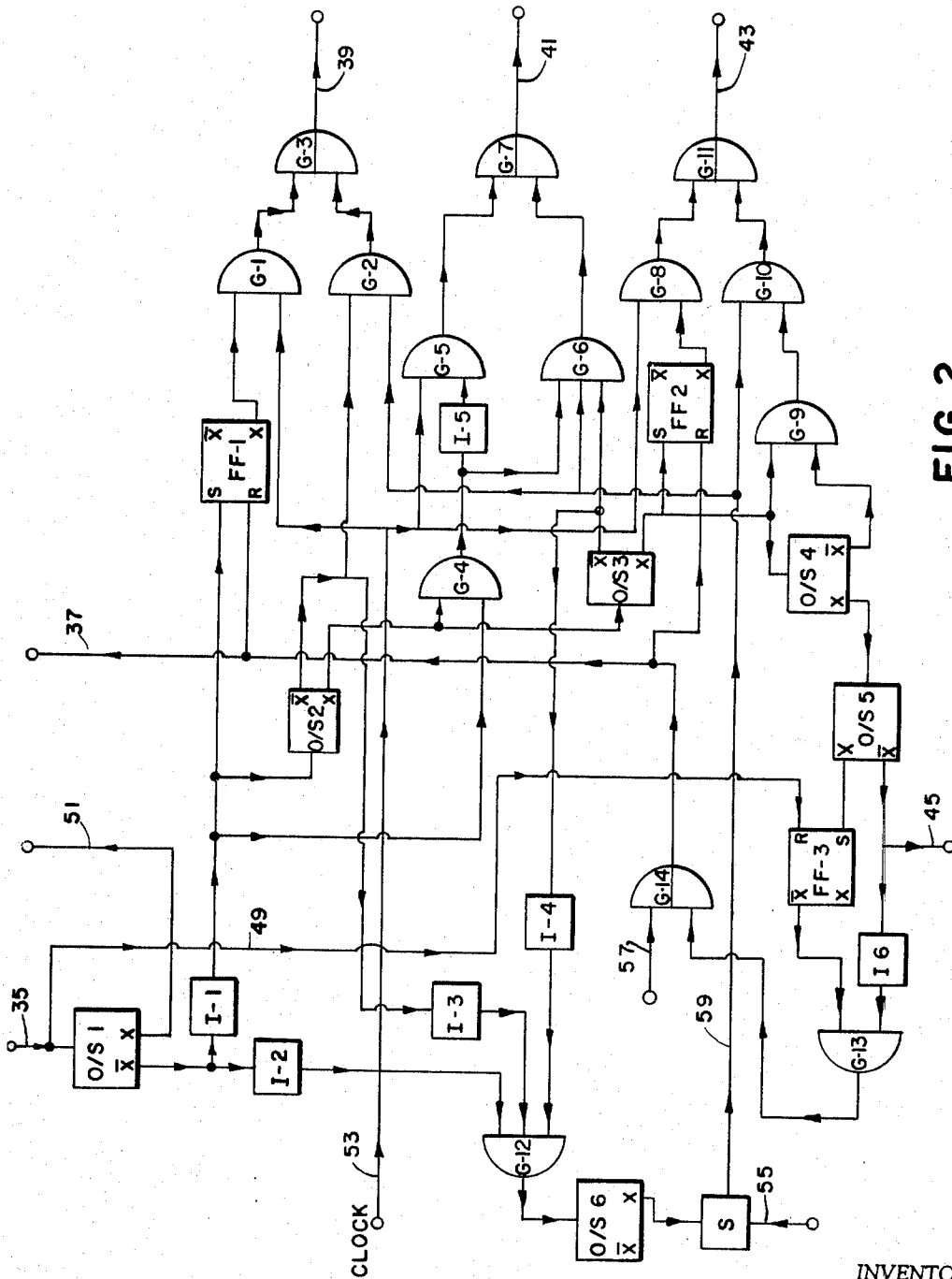


FIG. 2.

INVENTOR^S
James F. McGuire

Norman S. Babbitt

BY

Griffin & Brannon
ATTORNEYS

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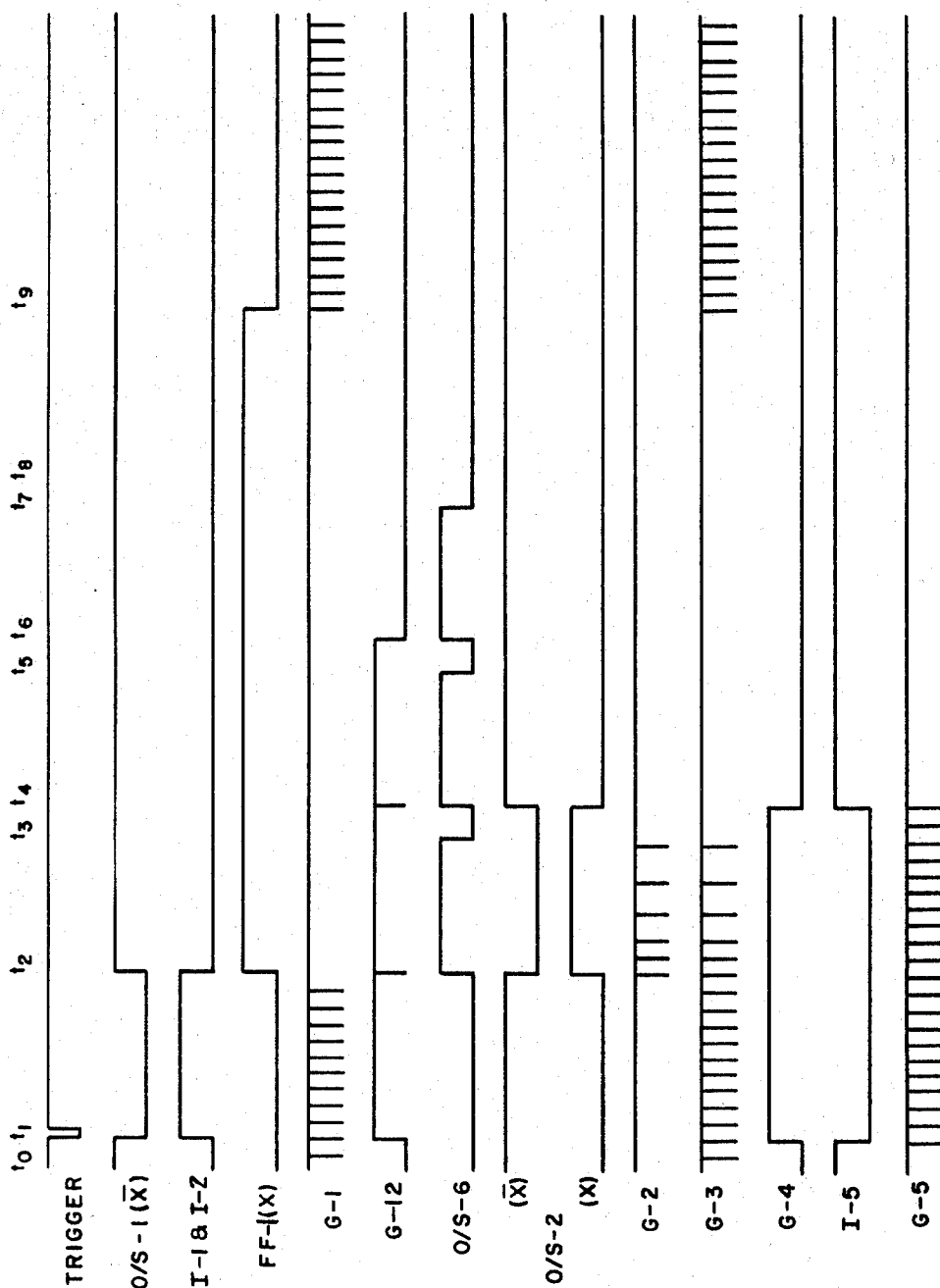


FIG. 3a.

LEGEND

FIG. 3a.
FIG. 3b.

INVENTORS

James F. McGuire

Norman S. Babbitt

BY

Griffin & Branger
ATTORNEYS

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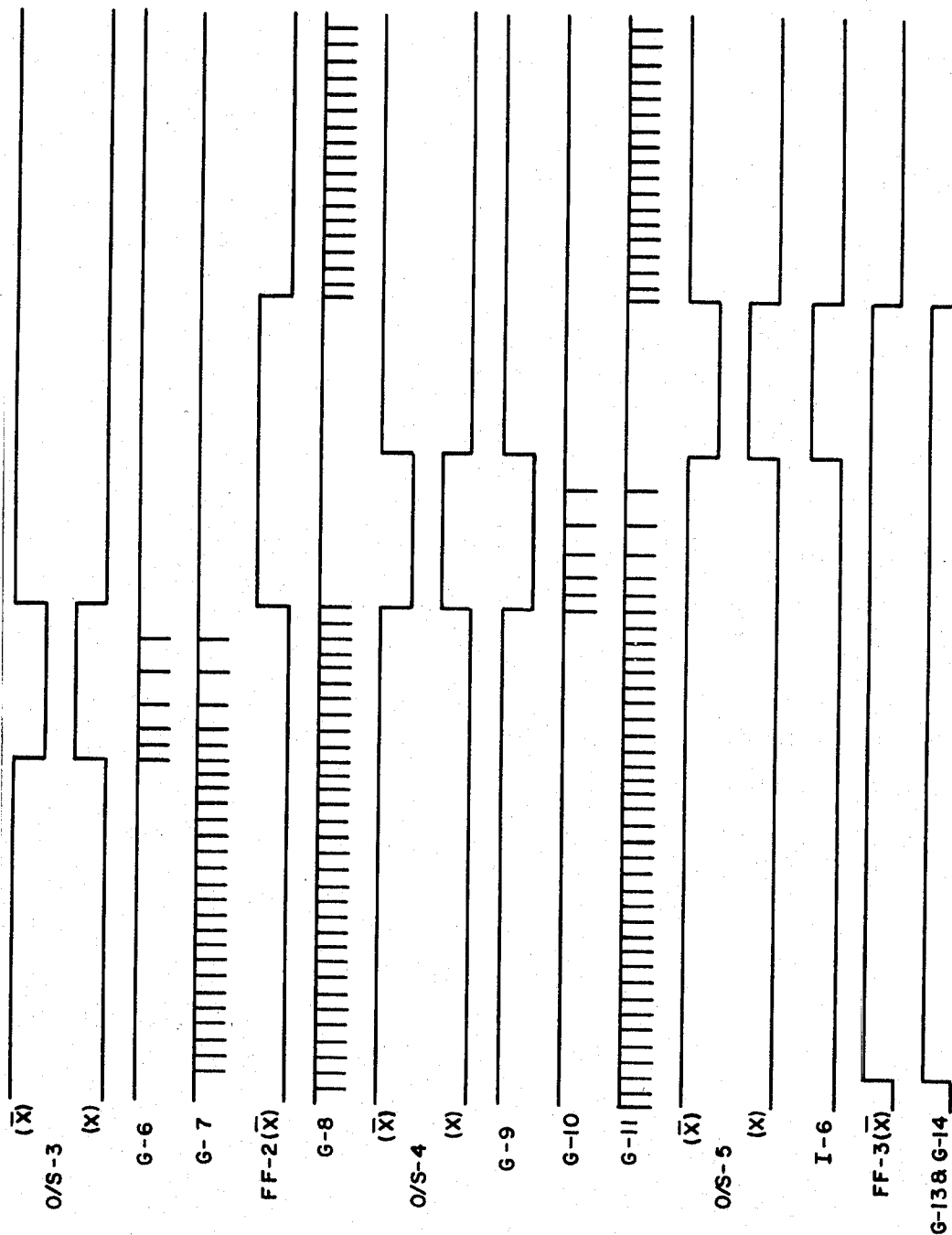


FIG. 3b.

INVENTORS
James F McGuire

Norman S. Babbitt

BY

Griffin & Branigan
ATTORNEYS

1

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3,439,281

APPARATUS FOR RANDOMLY CONTROLLING THE FLOW OF PULSES FROM A PULSE SOURCE TO A PLURALITY OF OUTPUT LINES

James F. McGuire, Hyattsville, Md., and Norman S. Babbitt, Falls Church, Va., assignors to James F. McGuire, Hyattsville, Md., Oscar C. Haertsch, Laurel, Md., Norman S. Babbitt, Falls Church, Va., and William E. Van Deusen, Jr., Seabrook, Md., as co-owners

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U.S. Cl. 328—153

4 Claims

ABSTRACT OF THE DISCLOSURE

In summary, this invention is an apparatus for randomly controlling the flow of pulses from a pulse source to a plurality of output lines in a chance amusement device wherein an electronic control means controls the application of pulses to a plurality of indicia control means. The indicia control means control the displaying of the indicia. The electronic control means selectively applies pulses to the indicia control means in a random manner so that indicia are randomly displayed. After a period of time the electronic control means inhibits the application of pulses to the indicia control means and the displays come to a stop.

This invention relates to amusement devices and more particularly to amusement devices which depend upon chance for their successful operation.

Chance amusement devices of the type with which this invention is primarily concerned are those amusement devices where an indicator means, adaptable to display a plurality of indicia, is controlled so that the various indicia are randomly, periodically displayed. After a period of time the indicia display stops varying and comes to a rest. The indicia displayed at the rest position determines the outcome of the game; that is, whether the operator of the game wins or loses. This rest indicia is a random indication or display which does not depend upon skill but is merely related to the odds of chance.

Generally, prior art means for creating the random operation of these types of chance devices have involved the use of mechanically moving indicators. The indicators may be wheels turning on a shaft. After a period of time the wheels are braked to a stop to end the game. The brake action may be caused by a friction brake or by an electromechanical brake.

The prior art devices fall within two categories, those entirely mechanical and those electromechanical. While both types of devices have been used their operation has not always been entirely satisfactory. Both the mechanical and electromechanical systems are subject to mechanical wear created by friction between moving elements. Further, because of the use of moving mechanical elements periodic servicing, in the form of oiling and greasing the moving parts as well as replacing them when they wear out, is required. Electromechanical systems of the prior art are subject to additional disadvantages. Specifically, prior art electromechanical systems utilize relays to control their operation. Relays are subject to sticking and contact destruction when operated over a period of time. Moreover, because mechanical parts must be controlled the relays normally operate at relatively high voltages and currents resulting in the possibility of electrically shocking a person operating the amusement device.

It will be appreciated that it would be desirable to provide a game of chance which is entirely electronic in nature, operates at low voltages, and is not subject to the

structural and electrical disadvantages of prior art devices.

Therefore, it is an object of this invention to provide a new and improved amusement device which operates upon the principle of chance.

It is also an object of this invention to provide a new and improved amusement device which utilizes only electronic components to provide both the indicia display and the control therefor.

It is further an object of this invention to provide a new and improved chance amusement device that is uncomplicated, reliable, generally service free, and operates on the principle of chance.

It is a still further object of this invention to provide a new and improved chance amusement device wherein an electronic means generates random signals to control the random displaying of indicia on a display device.

It is still another object of this invention to provide a new and improved electronic control system for generating random pulses.

In accordance with a principle of the invention the output of a pulse means is connected by a control means to an indicia control means. The output from the indicia control means is applied to a display means.

Prior to starting a game the pulse means is partially operating the indicia control means. When a game is commenced the output from the indicia control means starts to operate the display means. The pulse means is connected by the control means to fully operate the indicia control means. This partial then full operation provides randomness to the system. After the game has been in operation a predetermined period of time the pulse means is disabled by the control means to prevent the application of pulses to the indicia control means. Stopping pulses stop the display to end the game.

In accordance with a further principle of the invention a sample and reward means is connected to the output of the indicia control means to sample the indicia control output after it has stopped and to generate a reward when a rewardable output has occurred. Further means is provided to reset the system after a period of time. The time period is sufficiently long to allow a reward to be generated if one has resulted from the operation of the device.

It will be appreciated that the foregoing provides a simple apparatus for providing a chance amusement device. By controlling the application of pulses from a pulse means to an indicia control means the indicia control means operates in a random manner. By connecting the output from the indicia control means to a display, a random display is provided. Further, by coupling the output from the indicia control to a reward logic system a means is provided for rewarding a player at the end of a game if certain indicia are displayed.

The foregoing objects and many of the attendant advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a block diagram of the overall system of the invention;

FIG. 2 is a logic diagram of a control system suitable for use in the system illustrated in FIG. 1;

FIGS. 3a and 3b are timing diagrams of the logic network illustrated in FIG. 2;

FIG. 4 is a diagram of an indicia control suitable for use in the system illustrated in FIG. 1; and

FIG. 5 is a logic diagram of a reward system suitable for use in the system illustrated in FIG. 1.

Turning now to the drawings wherein like reference numerals indicate like parts throughout the several views;

FIG. 1 is a block diagram illustrating the overall system of the invention. The system illustrated in FIG. 1 comprises a trigger 11, a fixed frequency pulse source 13, a relaxation pulse source 15, a control system 17, a first indicia control 19, a second indicia control 21, a third indicia control 23, a status display 25, a first indicia display 27, a second indicia display 29, a third indicia display 31, and a reward system 33.

The output from the trigger 11 is applied along a line 35 to a first input of the control system 17. The output from the fixed frequency pulse source 13 is applied to a second input of the control system 17. And the output from the relaxation pulse source 15 is applied to a third input of the control system 17. First and second outputs of the control system 17 are applied along lines 37 and 51 to the status display 25 and to the first, second, and third indicia displays 27, 29, and 31. Third, fourth and fifth outputs of the control system are applied along a line 39 to the first indicia control 19, along a line 41 to the second indicia control 21 and along a third line 43 to the third indicia control 23, respectively.

The output of the first indicia control 19 is applied to the first indicia display 27, the output of the second indicia control 21 is applied to the second indicia display 29, and the output of the third indicia control 23 is applied to the third indicia display 31. The outputs from the first, second and third indicia controls are also applied to inputs of the reward system 33. A control input to the reward system 33 originates as an output from the control system 17 and passes along a line 45.

The status display 25 and the first, second and third indicia displays 27, 29, and 31 are preferably electro-optical display tubes of the type illustrated in U.S. Patent 2,751,584. The display on the face of these tubes is determined by the signals applied to their control elements; hence, by providing a continuously changing control signal to the indicia displays a continuously changing display system is provided. The indicia controls provide such a changing control signal as will be hereinafter described. Moreover, when the signals are constant the display is constant.

The trigger 11 is a pulse generating apparatus that is triggered to start a game by the insertion of a coin or a token, for example. Alternatively, the trigger action may be created by the closure of a switch. The fixed frequency pulse source 13 is preferably a pulse oscillator generating pulses at a steady predetermined frequency. The relaxation pulse source 15 is preferably a relaxation pulse oscillator; that is, it is a pulse generating oscillator wherein the output pulses start at a set frequency and reduce to zero. One such system is a voltage controlled oscillator wherein a capacitor is charged to a set value and connected to the oscillator. Thereafter, the capacitor's charge is allowed to reduce to zero. The voltage reduction to zero drops the frequency of the output pulses to zero. Preferably the starting frequency of the relaxation pulse source is the same as the predetermined frequency of the fixed frequency pulse source.

The control system 17 is adapted to apply pulses from the fixed frequency pulse source 13 to the first and third indicia control 19 and 23, prior to the reception of a pulse from the trigger 11. It also determines the setting of the display prior to the reception of a trigger pulse. Further, it prevents the outputs of the first and third indicia control from changing the display on the indicia displays; these stopped displays being the end of a prior game.

After a trigger pulse is received by the control system it sequentially performs the following functions: (1) changes the status display, allows the indicia displays to change, and applies pulses from the fixed frequency pulse source to the second indicia control 21 simultaneously; (2) stops the application of pulses from the fixed frequency pulse source and applies pulses from the relaxation pulse source to the first indicia control 19; (3) stops the application of pulses from the relaxation pulse source to

the first indicia control; (4) stops the application of pulses from the fixed frequency pulse source and applies pulses from the relaxation pulse source to the second indicia control 21; (5) stops the application of pulses from the relaxation pulse source to the second indicia control; (6) stops the application of pulses from the fixed frequency pulse source and applies pulses from the relaxation pulse source to the third indicia control 23; (7) stops the application of pulses from the relaxation pulse source to the third indicia control; (8) generates a reward sample pulse; and (9) resets the game.

Turning now to FIG. 2 which is a logic diagram of a control system that will perform the foregoing sequential control operations and FIG. 3 which is a timing diagram for FIG. 2; FIG. 2 comprises a first one shot multivibrator O/S1, a second one shot multivibrator O/S2, a third one shot multivibrator O/S3, a fourth one shot multivibrator O/S4, a fifth one shot multivibrator O/S5, a sixth one shot multivibrator O/S6, a first flip-flop FF1, a second flip-flop FF2, a third flip-flop FF3, a first AND gate G1, a second AND gate G2, a first OR gate G3, a third AND gate G4, a fourth AND gate G5, a fifth AND gate G6, a second OR gate G7, a sixth AND gate G8, a seventh AND gate G9, an eighth AND gate G10, a third OR gate G11, a tenth AND gate G12, a ninth AND gate G13, a fifth OR gate G14, a first inverter I1, a second inverter I2, a third inverter I3, a fourth inverter I4, a fifth inverter I5, a sixth inverter I6, and a switch S.

The control system illustrated in FIG. 2 operates in accordance with bilevel trigger signals. The level of the signal output from the various logic elements at any particular time in a game cycle are illustrated in FIG. 3. The lower level designates a "0" output and the upper level designates a "1" output. For ease of illustration all of the elements are operated by 0's. Specifically, the one shot multivibrators are triggered by 1 to 0 transitions; the flip-flops are set and reset by 1 to 0 transitions; the AND gates have 0 outputs only when all of their inputs are 0; and the OR gates have 0 outputs when any of their inputs are 0. Further, the output pulses from the fixed frequency pulse source and the relaxation pulse source are both chains of 0 pulses. In addition, the trigger pulse from the trigger 11 is a 0 pulse.

All of the AND gates except the fifth and tenth have dual inputs; the fifth and tenth AND gates have three inputs. All of the OR gates have dual inputs. All of the one shot multivibrators have both X and $\bar{X}$ output designations, when the one shot multivibrators are in their quiescent condition the X output is 0 and the $\bar{X}$ output is 1. When the one shots are triggered their outputs shift to their opposite states. The outputs from the flip-flops are also designated as X and $\bar{X}$. These X's and $\bar{X}$'s are 0's and 1's, respectively, for the reset condition of the flip-flops. When the flip-flops are set their output voltage states reverse.

The trigger input along the line 35 is applied to the input of the first one shot multivibrator O/S1. This input is also applied along a line 49 to the reset input of the third flip-flop FF3. The X output from the first one shot is applied along a line 51 to the status display 25 and the first, second, and third indicia displays 27, 29, and 31 as illustrated in FIG. 1. The $\bar{X}$ output from the first one shot O/S1 is connected to the inputs of the first inverter I1 and the second inverter I2. The output from the first inverter I1 is connected to the set input of the first flip-flop FF1, to one input of the third AND gate G4, and to the input of the second one shot O/S2. The output from the second inverter I2 is connected to one input of the tenth AND gate G12.

The input from the fixed frequency pulse source 13 passes along a line 53 and is applied to one input of the first AND gate G1, one input of the fourth AND gate G5, and one input of the sixth AND gate G8. The $\bar{X}$ output of the first flip-flop FF1 is connected to the second input of the first AND gate G1. The output from the first

AND gate G1 is applied to one input of the first OR gate G3.

The $\bar{X}$ output of the second one shot O/S2 is connected to one input of the second AND gate G2 and, through the third inverter I3 is connected to the second input of the tenth AND gate G12. The input from the relaxation pulse source 13 is applied along a line 55 to the signal input of the switch S. The output from the switch S is applied along a line 59 to the second input of the second AND gate G2, to one input of the fifth AND gate G6, and to one input of the eighth AND gate G10. The output from the second AND gate G2 is connected to the second input of the first OR gate G3.

The X output from the second one shot O/S2 is applied to one input of the third AND gate G4 and to the input of the third one shot O/S3. The output from the third AND gate G4 is connected, through the fifth inverter I5, to the second input of the fourth AND gate G5 is applied to one input of the second OR gate G7.

The output of the third AND gate G4 is also applied to the second input of the fifth AND gate G6. The $\bar{X}$ output from the third one shot multivibrator O/S3 is applied to the third input of the fifth AND gate G6 and through the inverter I4, to the third input of the tenth AND gate G12. The output of the fifth AND gate G6 is applied to the second input of the second OR gate G7.

The X output from the third one shot O/S3 is applied to the set input of the second flip-flop FF2; to one input of the seventh AND gate G9; and to the input of the fourth one shot O/S4. The X output of the second flip-flop is applied to the second input of the sixth AND gate G8. The output from the sixth AND gate G8 is applied to one input of the third OR gate G11. The $\bar{X}$ output from the fourth one shot O/S4 is applied to the second input of the seventh AND gate G9. The output from the seventh AND gate G9 is applied to the second input of the eighth AND gate G10. The output of the eighth AND gate G10 is connected to the second input of the third OR gate G11.

The X output of the fourth one shot is applied to the input of the fifth one shot O/S5. The $\bar{X}$ output from the fifth one shot is applied through the sixth inverter I6 to one input of the ninth AND gate G13 and to the line 45. The line 45 is connected to the reward network 33.

The X output of the fifth one shot O/S5 is applied to the set input of the third flip-flop FF3. The $\bar{X}$ output from the third flip-flop FF3 is connected to the second input of the ninth AND gate G13, and the output of the ninth AND gate G13 is applied to one input of the fifth OR gate G14. The fifth OR gate G14 has a second input connected to an external reset source along a line 57. The output from the fifth OR gate G14 is applied to the reset input of the first and second flip-flops FF1 and FF2 and to line 37.

The output from the tenth AND gate G12 is applied to the input of the sixth one shot O/S6 and the $\bar{X}$ output of the sixth one shot is applied to the control input of the switch S. The output from the first OR gate G3 is applied to the line 39, the output from the second OR gate G7 is applied to the line 41 and the output from the third OR gate G11 is applied to the line 43. The lines 39, 41, and 43 run to the first, second, and third indicia controls 19, 21, and 23.

Turning now to the logic operation of the control system illustrated in FIG. 2 and its timing diagram as illustrated in FIG. 3, FIG. 3 illustrates that at time t_0 (prior to starting the game) pulses are flowing out of the first OR gate G3 and the third OR gate G11 but not out of the second OR gate G7. These pulses are being applied to the first and third indicia controls, hence, the first and third indicia controls are changing but the second is not.

Upon the occurrence of a trigger pulse, illustrated at time t_1 in FIG. 3, several operations simultaneously occur. The first one shot O/S1 is triggered, and the third flip-flop FF3 is reset. When the first one shot is triggered its

X and $\bar{X}$ outputs are reversed. A 1 is now applied through line 51 to the status display 25 to shift the status display from its previous display to a new display. More specifically, the status display could have been displaying "Start Game" and after a signal from the one shot is applied to it, it could display "Game In Progress," for example. Further, the 1 on line 51 allows the indicia displays to change. This abling, and disabling of indicia displays, although not shown, could be accomplished by the pulse 51 triggering a long time constant one shot multivibrator. The one shot would disable the application of indicia display signals when set and able the application of pulses when reset through conventional gating action. In general, any suitable means for accomplishing the desired result can be used.

The $\bar{X}$ output of the first one shot O/S1 is a 0 at time t_1 , this 0 is inverted by the first and second inverters I1 and I2. Hence, a 1 is applied to the tenth AND gate G12 by the second inverter I2 and a 1 is applied to the set side of the first flip-flop FF1, to the second one shot O/S2 and to the third AND gate G4 by the first inverter I1. These 1's do not operate either the first flip-flop or the second one shot, nor is there any output from the tenth AND gate. However, the output from the third AND gate G4 changes. Specifically, prior to the firing of the first one shot both of the inputs to the third AND gate were 0's and it had a 0 output. This 0 output was inverted by the fifth inverter I5 resulting in the application of a 1 or inhibiting signal to the fourth AND gate G5. This inhibiting input prevented the application of pulses from the fixed frequency pulse source to line 41. When a 1 is applied to one input of the third AND gate G4 its output changes to a 1. This 1 is inverted by the fifth inverter I5 resulting in the application of a 0 input to the previously inhibiting input of the fourth AND gate G5. Now pulses from the fixed frequency pulse source are applied to line 41. This is illustrated on line G7 of FIG. 3. Hence, pulses are now applied to the second indicia control as well as to the first and third indicia controls.

The application of pulses from the fixed frequency pulse source to all three indicia controls continues from time t_1 to time t_2 . At time t_2 the first one shot ends its cycle and reverts to its quiescent condition. At this time a 1 is applied to the first and second inverters I1 and I2. The output from I2 becomes 0, this passes through the tenth AND gate G12 and triggers the sixth one shot O/S6. This X output from the sixth one shot controls the switch S in a manner that allows pulses from the relaxation pulse source to be applied to the line 59. The line 59 is connected to one of the inputs of the second AND gate G2.

At time t_2 the output from the first inverter I1 becomes a zero and triggers the first flip-flop FF1. The first flip-flop then applies a 1 to the first AND gate G1; this 1 inhibits the first AND gate and prevents pulses on line 53 from passing through it. The output from the first inverter I1 also triggers the second one shot O/S2. The $\bar{X}$ output from that one shot now applies a 0 to the second input of the second AND gate G2. Since when pulses occur both inputs to the second AND gate are 0 signals, the gate has an output. This output is a chain of slow down negative pulses. These pulses flow through the first OR gate G3 and are applied to the first indicia control 19 along line 39. These pulses as illustrated on line G3 of FIG. 3 are adapted between times t_2 and t_3 to slow down to zero. Hence, at time t_3 the pulses to the first indicia control are ended.

It should be noted that at time t_2 both of the inputs to the third AND gate G4 change. That is, the input from the second O/S2 changes from a 0 to a 1 and the input from the first inverter I1 changes from a 1 to a 0. However, because it still has 1 and 0 inputs the output of the

7

third AND gate G4 is still a 1. This output is still inverted by the fifth inverter I5 to provide a 0 to the fourth AND gate G5. Hence, the output of that gate is still a chain of negative pulses from the fixed frequency pulse source 13. And these pulses are still applied to the second indicia control 21.

At time *t*3 the sixth one shot O/S6 reaches the end of its cycle and reverts to its quiescent condition. This reversion switches the switch S to prevent relaxation pulse source pulses from reaching the output of the first OR gate G3. Hence, even if the pulses from the relaxation pulse source have reached zero they are now cut off and no more pulses are applied to line 39. Between time *t*3 and time *t*4 the relaxation pulse source builds back to its initial condition for the subsequent application of pulses to the second indicia control 21 as hereinafter described.

At time *t*4 the second one shot O/S2 ends its cycle and reverts to its quiescent condition. This reversion applies a 1 to one input of the second AND gate to inhibit it from the further application of line 59 pulses to the first indicia control. This reversion also applies a 0 to one input of the third AND gate G4 and triggers the third one shot O/S3. Since there are 0's now applied to both of the inputs to the third AND gate G4 its output becomes a 0. This 0 is inverted by inverter I5; hence, a 1 is applied to one input of the fourth AND gate G5. This 1 inhibits that gate and prevents the further flow of fixed frequency pulse source pulses through that gate. Further, when the second one shot O/S2 reverts to its quiescent condition its $\bar{X}$ output applies a 1 to the third inverter I3 which is inverted so that momentarily 0's are applied to all of the inputs of the tenth AND gate G12. These 0's pass through the tenth AND gate and trigger the sixth one shot O/S6. This triggering causes the switch S to allow pulses to flow from the relaxation pulse source to line 59. Line 59 is connected to one input of the fifth AND gate G6. In addition, when the second one shot dropped back to its quiescent condition it fired the third one shot which applied a 0 signal to the third input of the fifth AND gate G6. The second input to that AND gate is the output of the third AND gate G4 which is now 0 because both of its inputs (from O/S2 and from I1) are 0. Hence, the inputs of the fifth AND gate G6 are two 0 gating signals and a series of slow down pulses. Therefore, the output is a series of slow down negative pulses which flow through the second OR gate G7 and are applied to the second indicia control 21. This output is illustrated from time *t*4 to time *t*5 on line G7 of FIG. 3. At time *t*5 the pulses reach 0. Hence, at time *t*5 both the first and second indicia controls are not receiving pulses. At this time the sixth one shot O/S6 again reaches the end of its cycle and turns off the switch S. From time *t*5 to *t*6 the relaxation pulse source is again allowed to reset.

At time *t*6 the third one shot O/S3 reverts to its quiescent condition. The $\bar{X}$ output from the third one shot is now applied to the fifth AND gate G6 to inhibit the flow of any further pulses through it to line 41. A 1 is also applied by the third one shot to the fourth inverter I4 so that 0's are applied to all of the inputs of the tenth AND gate G12. These 0's again trigger the sixth one shot O/S6 to open the switch so that a chain of slow down pulses will be applied to line 59. The resetting of the third one shot O/S3 to its quiescent condition also applies a 0 to the set side of the second flip-flop FF2. The setting of the second flip-flop applies a 1 to one input of the sixth AND gate G8. This gate is then inhibited from passing any more pulses from the fixed frequency pulse source 13. In addition, the reverting of the third one shot O/S3 both triggers the fourth one shot O/S4 and applies a 0 to one input of the seventh AND gate G9. The firing of the fourth one shot O/S4 applies a 0 to the second input of the seventh AND gate G9; hence, its output is 0. The 0 output of the seventh AND gate is applied to the second input of the eighth AND gate G10. The first input to the eighth AND

8

gate G10 are the pulses on line 59. Hence, the output from the eighth AND gate G10 is a slow down chain of pulses. These pulses are applied to and pass through the third OR gate G11. The pulses from the third OR gate are applied to line 43. During the period between time *t*6 and time *t*7 these pulses slow down to zero. At time *t*7 the sixth one shot O/S6 again reverts to its quiescent condition to inhibit the switch S. Hence, at time *t*7 none of the indicia controls are receiving pulses.

At time *t*8 the fourth one shot O/S4 reverts to its quiescent condition and applies a 0 to the fifth one shot O/S5 which fires it. The fifth one shot applies a 0 signal to line 45. This 0 tells the reward network to sample the signals from the indicia controls as will be hereinafter described in conjunction with FIG. 5.

After a time (*t*8 to *t*9) of sufficient duration to allow the reward system to sample the outputs of the indicia controls and to provide a reward if one is designated the fifth one shot reverts to its quiescent condition. When the fifth one shot O/S5 reverts it applies a 1 to the sixth inverter I6. The sixth inverter I6 inverts this 1 and applies a 0 to one input of the ninth AND gate 13. When the fifth one shot reverts it also applies a 0 to the set input of the third flip-flop FF3. The setting of the third flip-flop applies 0 to the second input of the ninth AND gate G13. Hence, at time *t*9 the output from the ninth AND gate G13 is a 0. This 0 passes through the fifth OR gate G14 and is applied to line 37. It also is applied to the reset inputs of the first and second flip-flop to reset them to allow pulses from the fixed pulse source to flow through the first AND gate G1 and the sixth AND gate G8 and be applied to lines 39 and 43. The signal that flows along line 37 is adapted to reset the status display to "Start Game," for example, and is adapted to disable the indicia displays from changing. Hence, at time *t*9 the game is reset to its initial condition.

In addition to the resetting of the game after it has been played an external reset is adapted to pass along line 57 and through the fifth OR gate G14 so that the device can be externally reset at any time.

It will be appreciated that the foregoing is a simple electronic circuit for random control of the pulses on lines 39, 41, and 43. Specifically, a fixed frequency pulse source and a relaxation pulse source are sequentially applied to these lines to slow down the pulses applied by the indicia controls until all three indicia controls are stopped. Once they are stopped they remain stopped until the game is completed or externally reset. After the indicia controls are stopped a sample of their outputs is taken. This sampling determines whether a reward is to be given. Hence, a simple electronic system is provided for controlling a random operating game.

Turning now to FIG. 4 which is a logic diagram of an indicia control suitable for use in the system illustrated in FIG. 1. The network illustrated in FIG. 4 comprises a ring counter 61, a first OR gate 65, a second OR gate 67, a third OR gate 69, and a fourth OR gate 71. Preferably, the OR gates are adapted to pass 0's. The ring counter is conventional and may comprise a plurality of bistable flip-flops connected in a series. Each time a trigger pulse is applied to the counter data in one stage shifts to the next stage; that is, if a stage is set to provide a 1 output this 1 is shifted to the next stage upon the application of a trigger pulse or if a stage contains a 0, this 0 shifted to the next stage when a trigger pulse is applied. The output from the last stage is applied to the input of the first stage. By initially setting the ring counter so that the outputs from all of the stages except one or 1 and the single stage is 0, a 0 will be shifted through the counter.

In FIG. 4 the outputs from each stage are designated as lines 63a through 63o. Lines 63a, 63f, 63g, 63i, 63l, and 63o are connected to the first OR gate 65. Lines 63b, 63e, and 63k are connected to the second OR gate 67. Lines 63d, 63h, 63j, and 63m, are all connected to

the third OR gate 69. Finally, the lines 63c and 63n are connected to the fourth OR gate 71. The outputs from the first, second, third and fourth OR gates are adapted to be connected to the indicia display. For example, the indicia display could be represented as a matrix of lights. Each output could be applied to one of these lights for a different indication. Or, the indicia display means could include a display tube of the type illustrated in U.S. Patent 2,751,584. This tube displays indicia in accordance with the signals applied to it. The outputs from the OR gates vary the applied signals so that varying indicia are displayed. In either case different signals at different times cause different displays.

Since each time the ring counter is triggered the 0 shifts one stage it will pass through the first OR gate 65 five times in one ring counter cycle. Similarly it will pass through the second OR gate 67 three times, the third OR gate 69 four times and the fourth OR gate 71 twice in each ring counter cycle.

Hence, random 0's are applied to the indicia display and random display occur. This interconnection provides a control of the number of times a specific indicia will be displayed on the face of the indicia display per cycle of the ring counter. In addition to connecting the outputs from the OR gates to the indicia display they are also connected to the reward system illustrated in FIG. 5.

Turning now to FIG. 5 which illustrates the logical reward system suitable for use in the system illustrated in FIG. 1; the system illustrated in FIG. 5 comprises four reward AND gates 73, 75, 77 and 79. Each AND gate has four inputs and is, preferably, adapted to generate a 0 output when it has 0's on all of its inputs. The four inputs from each of the indicia controls are illustrated as lines 95a-95d, 97a-97d, 99a-99d. These lines are selectively connected to the four reward AND gates 73-79. Specifically, lines 95a, 97b, 99c, are applied to three of the inputs of the first AND gate 73. Lines 95b, 97a, and 99b are applied to three of the inputs of the second AND gate 75. Lines 95c, 97c, and 99a are applied to three of the inputs of the third AND gate 77. And lines 95d, 97d, and 99d are applied to three of the inputs of the fourth AND gate 79. In addition, the sample signal on line 45 is applied as one input to all of the AND gates. Hence, the AND gates will generate no output signals unless a sample signal is being applied along line 45.

The outputs of the four AND gates are applied to the output terminals to provide either reward signals or to control, for example, a clock to pay out a particular reward at a particular period of time. There are numerous ways of carrying out the actual reward. The specific way to perform the reward function is not considered part of the invention.

In operation, when a sample signal is applied along the line 45 it controls whether or not any of the four AND gates 73-79 generates an output. If one of these AND gates has 0 inputs on its other three lines due to a particular condition existing at the outputs of the indicia controls a reward signal is applied along its output line. This reward signal then creates the reward. After a predetermined period of time equal in length for a reward to occur the game is reset as hereinbefore described.

It will be appreciated that the foregoing description has described a very simple chance amusement device. An electronic control system randomly controls the game's indicia. By applying the outputs of ring counters to a plurality of OR gates the number of times a particular indicia occurs can be controlled. Hence, the reward can be controlled. For example, the reward for a plurality of numerous occurring indicia would normally be less than the reward for a seldom occurring indicia. This can be controlled through the reward logic illustrated in FIG. 5.

It will be appreciated that the number of outputs from

the ring counters and the number of reward gates have, for illustration purposes, been reduced from the number that would normally be utilized in an actual embodiment of the invention. Specifically, the ring counter has been illustrated as having fifteen outputs connected to four OR gates to generate four indicia signals to one indicia display. However, there could be a considerably larger number of ring counter outputs connected to a larger number of OR gates to control a larger number of indicia in a single indicia display. For example, there could be thirty outputs through ten OR gates to provide ten different indicia occurring on the face of one tube during a ring counter cycle.

Similarly, the use of only four AND gates in the reward logic illustrated in FIG. 5 is simplified. Specifically, there may be only four rewards but the combination required to achieve them could be made more complicated.

It will be appreciated by those skilled in the art that the relaxation pulse means is not essential to the random operation of the device. Specifically, the relaxation pulse means provides for displays that slow to a stop to give the effect of a wheel edge being braked to a stop. However, the relaxation pulse source does not significantly aid in giving randomness to the system. Randomness is provided by the control selectively connecting the fixed pulse source to the indicia controls.

In addition, the use of four indicia displays and four indicia controls is only by way of example. By utilizing additional logic elements for the sequential application of fixed frequency and relaxation pulses to additional indicia controls, a larger system can be created.

Further, it will be appreciated by those skilled in the art that the herein described system is a control that could be used to operate parallel systems. Specifically, a number of indicator displays could be connected in parallel with those herein described. These parallel displays could be "picked up" or switched into operation when a token or coin is inserted into the slot for a certain machine with each machine being able to trigger the control. Hence, a multiple machine, operable by a plurality of players, may be provided. However, because of the parallelness of the system, all of the player's rewards will be the same.

Therefore, it will be appreciated that the invention may be practiced otherwise than as specifically described herein.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for randomly controlling the flow of pulses from a pulse source to a plurality of output lines comprising:

- a pulse source;
- a plurality of output lines;
- a trigger means for generating a switching pulse after the receipt of a trigger pulse;

first means connected to said trigger means and connected between said pulse source and selected members of said plurality of output lines for applying pulses to said selected members prior to the generation of a switching pulse by said trigger means; and second means connected to said trigger means and connected between said pulse source means and the remaining members of said plurality of lines for inhibiting the application of pulses to said remaining members prior to the generation of a switching pulse by said trigger means and for applying pulses to said remaining members subsequent to the generation of a switching pulse by said trigger means.

2. Apparatus as claimed in claim 1 including further means for sequentially inhibiting the application of pulses to said plurality of lines after said trigger means has generated a switching pulse.

3. Apparatus as claimed in claim 2 wherein said pulse

source includes a relaxation oscillator and a fixed frequency oscillator.

4. Apparatus as claimed in claim 3 wherein said first, second, and further means comprise:

- eight AND gates having dual inputs and two AND gates having three inputs; 5
- four OR gates having dual inputs;
- three flip-flops each having a set and a reset input and an X and $\bar{X}$ output;
- six one-shot multivibrators each having an X and an $\bar{X}$ output; 10
- six inverters;
- a switch having a control input, a signal input and an output;
- the input from said first pulse source means connected to said first, fourth, and sixth AND gates; 15
- the input from said trigger means being connected to said first one shot multivibrator and to the reset input of said third flip-flop;
- the $\bar{X}$ output of said first one shot multivibrator connected to said first and second inverters; 20
- the output from said first inverter connected to the set input of said first flip-flop, the input of said second one shot, and one input of said third AND gate;
- the output from said second inverter connected to one input of the first of said three input AND gates; 25
- the X output from said first flip-flop connected to the second input of said first AND gate;
- the $\bar{X}$ output from said second one shot connected to one input of said second AND gate and to said third inverter; 30
- the output from said third inverter connected to a second input of the first of said three input AND gates;
- the X output from said second one shot connected to the second input of the third AND gate and to the input of the third one shot multivibrator; 35
- the outputs of said first and second AND gates connected to the inputs of said first OR gate;
- the outputs of said third AND gate connected through said fifth inverter to a second input of said fourth AND gate; 40
- the output of said third AND gate also connected to one input of the second of said three input AND gates;
- the $\bar{X}$ output of said third one shot connected to a second input of the second of said three input AND gates and through said fourth inverter to a third input of the first of said three input AND gates; 45
- the X output of said third one shot connected to the set input of said second flip-flop, one input of said

- seventh AND gate and the input of said fourth one shot;
- the X output of said second flip-flop connected to the second input of said sixth AND gate;
- the $\bar{X}$ output of said fourth one shot multivibrator connected to the second input of said seventh AND gate;
- the output of said seventh AND gate connected to one input of said eighth AND gate;
- the output of said fourth AND gate and the output of the second of three input AND gates connected to the inputs of said second OR gate;
- the outputs of said sixth and eighth AND gates being connected to the inputs of said third OR gate;
- the X output of said fourth one shot connected to the input of said fifth one shot;
- the $\bar{X}$ output of said fifth one shot connected through said sixth inverter to one input of said ninth AND gate;
- the X output of said fifth one shot connected to the set input of said third flip-flop;
- the $\bar{X}$ output of said third flip-flop connected to a second input of said ninth AND gate;
- the output of said ninth AND gate connected to one input of said fourth OR gate;
- the output of said fourth OR gate connected to the reset input of said second flip-flop and said first flip-flop;
- the output of the first of said three input AND gates connected to the input of said sixth one shot;
- the X output of said sixth one shot connected to the control input of said switch;
- the signal input of said switch adapted for connection to said second pulse means; and
- the output of said switch connected to one input of the second and eighth AND gates and to the third input of the second of said three input AND gates.

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ANTON O. OECHSLE, *Primary Examiner.*

ARNOLD W. KRAMER, *Assistant Examiner.*

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