

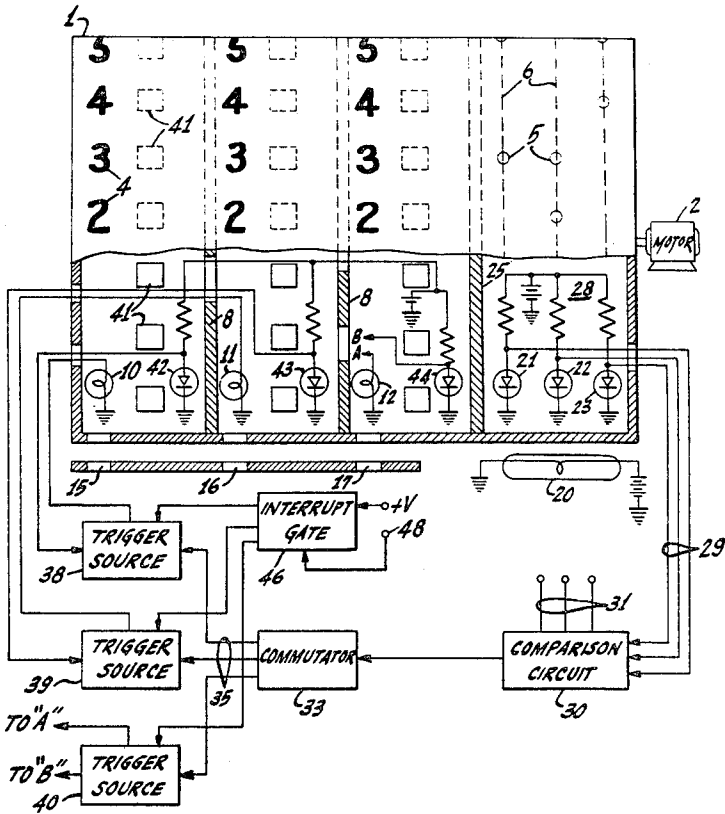
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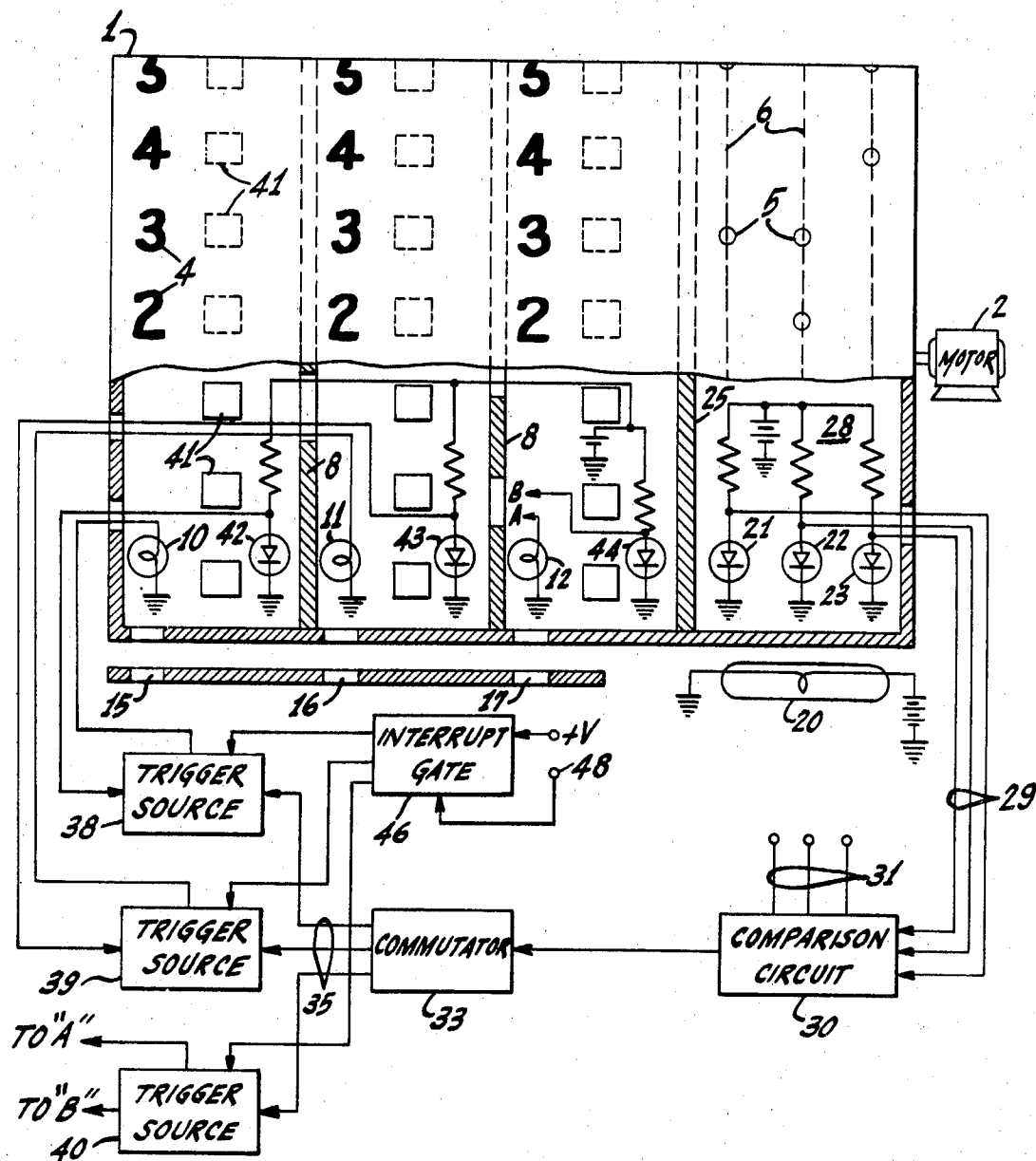
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[54] **STROBOSCOPIC DISPLAY APPARATUS**
9 Claims, 1 Drawing Fig.
[52] U.S. Cl..... **340/324,**
178/30, 250/77
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H01j 37/24
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250/72, 77, 219I(d), 219I(dd), (Inquired)

ABSTRACT: A stroboscopic display system having a continuously driven display medium with means to initially enable a momentary illuminating means to display selected characters, and an independent secondary means to automatically enable the illuminating means to display the selected characters after this initial operation until selectively interrupted.





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STROBOSCOPIC DISPLAY APPARATUS

BACKGROUND OF THE INVENTION

Stroboscopic display devices using continuously rotating display elements carrying display characters with high-speed flash lamps for momentarily illuminating selected characters have been known in the prior art. An example of such a prior art device is shown in U.S. Pat. No. 2,633,297. However, such devices have heretofore used a data storage element for storing input data on each selected character in order to provide means for retriggering the lamps during successive rotations of the display elements. Such system, accordingly, have been inherently electronically complex and, as a result, have been unsuccessful in providing a low cost and reliable display system.

An object of the present invention is to provide a stroboscopic display system having a simplified electronic structure using a lamp retriggering means which is automatically operated by the rotation of the display elements.

BRIEF SUMMARY OF THE INVENTION

The illustrated embodiment of the present invention is a stroboscopic display apparatus using a continuously rotating display medium having display characters thereon. A high-speed illuminating means is arranged to illuminate selected ones of the characters during each rotation of the display medium. The illuminating means is operated by a primary control means to illuminate selected ones of the characters. A secondary control means is arranged to retrigger the illuminating means independently of the primary control means during successive revolutions of the display means.

BRIEF DESCRIPTION OF THE DRAWING

The single FIG. drawing is a pictorial diagram of a stroboscopic display apparatus embodying the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is illustrated as a stroboscopic display apparatus using a continuously rotating display medium having display characters thereon. The characters are identified by code data located on the display medium and fixedly aligned with the characters. A high-speed illuminating means, e.g. stroboscopic lamps, is arranged to momentarily illuminate selected characters during each rotation of the display medium. The illuminating means is initially selectively triggered by a code comparison means which is operative to compare the character identifying code on the medium with input code information applied to select display characters. A secondary lamp retriggering means is operative to automatically retrigger the selected lamps during successive rotations of the medium independently of the operation of the code comparison means. This secondary means is operated by the signal developed from a fixed photocell which is activated by one of a plurality of patches of phosphorescent material located on the medium adjacent to the respective ones of the characters. The patches are stimulated into emitting light by the operation of the lamps which are thus effective to select the patches to be stimulated. The second trigger signal is developed during each rotation of the display medium until affirmatively interrupted by an interrupt means.

Referring to the figure in more detail, there is shown a display system having a suitable display medium, e.g., rotating drum 1 driven by a motor 2. While a drum is shown for purposes of illustration, it should be noted that other display mediums such as an endless tape loop, a disc, etc. are possible without departing from the scope of the present invention. The drum 1, which is generally opaque, has transparent portions in its surface corresponding to the characters which are to be viewed, e.g., the characters 4. The characters 4 are arranged in parallel circumferential bands around the periphery of the drum 1 with similar characters positioned on a horizontal line, e.g., parallel to the axis of drum 1. These character bands are shown in exemplary form as three bands arranged to occupy approximately one-half of the surface of the drum 1.

A portion of the remainder of the drum surface has code information, e.g., binary code, corresponding to the characters 4, in the form of transparent portions 5. The code information is also arranged in parallel circumferential tracks 6 on the surface of the drum 1. This code information is associated with corresponding horizontal lines of the characters 4 and serves to identify the characters 4 for the associated logic system as hereinafter explained.

The interior of the drum 1 shown in cutaway form in the FIGURE, has a plurality of opaque partitions 8 with the spacing of the partitions 8 being similar to the band spacing of the characters 4, i.e., a band of the characters 4 is positioned along a line between two of the partitions 8. Each of these partitioned spaces has an illuminating means, e.g., a high-speed light source, positioned therein. These illuminating means are shown as lamps 10, 11 and 12. A plurality of viewing windows 15, 16 and 17 are located exterior to the drum 1 and aligned with the lamps 10, 11, and 12, respectively.

A separate light source 20 is positioned adjacent to that exterior portion of the surface of the drum 4 which carries the code information holes 5. Three light sensitive detectors, e.g., photocells 21, 22 and 23 are positioned within the drum 4 and aligned with respective ones of the code tracks 6. Thus, each code track has an individual detector associated with it, while the light source 20 is used as a general source of illumination for all of the code tracks 6. The photocell detectors 21 to 23 are located in a section of the interior of the drum 1 which is separated from the rest of the drum interior by an interior partition 25. Thus, the photocells are isolated from the light sources 10 to 12 and are affected only by the light passing through the code holes 5 from the source 20.

The three code photocells 21 to 23 are connected to a circuit means 28 operative to develop an output signal on a respective output line when a photocell is illuminated by the light source 20 through the code holes 5. The output signals from the photocells 21 to 23, which are coded in accordance with the arrangement of the holes 5, are applied over lines 29 to a suitable signal comparison circuit 30. The comparison circuit 30 is arranged to compare the aforesaid photocell signals with coded signals in input lines 31. These input signals may be supplied from any appropriate source (not shown), such as, a digital computer. The comparison circuit 30 is operative to produce an output signal indicative of a coincidence between the coded input signals and the photocell signals. This output signal is applied to a signal commutator means 33.

The commutator 33 is cyclically operated to distribute this signal from the comparator 30 to one of a plurality of output lines 35. The output lines 35 are connected to respective ones of a plurality of trigger sources 38, 39 and 40. The output signal from the commutator 33 is applied as an enabling signal to the trigger sources 38 to 40. A second enabling signal for the trigger sources 38 to 40 is obtained from respective photosensitive transducers, shown as photocells 42, 43 and 44. These photocells 42 and 44 are located in respective ones of the spaces defined by the partitions 8 and in the general vicinity of the light sources 10 to 12, respectively.

A group of phosphorescent patches 41 is located on the interior surface of the drum 1 between each of the partitions 8. Each of the patches in each group is aligned with a respective horizontal row of the characters 4. For example, a first group of patches 41 is located between the left end of the drum 1 and the first partition 8 with each of the patches 41 being positioned adjacent to a corresponding one of the characters 4 in the first character band. The patches 41 are arranged to pass by the light source 10 and the photocell 42 when the drum 1 is rotating. Thus, the patches 41 are selectively illuminated by the light source 10 and, in turn, are effective to produce light during the active time of the phosphorescent material, i.e., during the time that the patch continues to emit light after and initial stimulation by the light source 10. Accordingly, the active patch is operative to illuminate the photocell 42 when the rotation of the drum 1 is effective to bring the patch adjacent to the photocell 42.

The photocells 42 to 44 are arranged in a suitable circuit to produce an output signal when they are illuminated by either their respective light sources or an active phosphorescent patch. The output signals from these photocells 42 to 44 are, as previously explained, applied to the trigger sources 38 to 40, respectively. The supply voltage for the trigger sources 38 to 40 is applied through an "interrupt" gate circuit 46. The gate circuit 46 is controlled by a signal from a fifth input line 48, which line 48 is also supplied by the aforesaid input signal source (not shown).

In operation, the display apparatus of the present invention is operative to produce a visible display in the viewing windows 15 to 17 using the characters 4 which are selectively illuminated by the lamps 10 to 12. The characters in each character band are selected by the coded input signals applied on input lines 31. These input signals are compared by the comparator 30 with coded signals from the photocells 21 to 23. Since the photocell signals are derived from the code holes 5, they are representative of the position of the characters 4 while the drum 1 is continuously rotating. When a coincidence is detected by the comparator 30 between the compared signals, an output signal is supplied to the commutator 33 to be distributed to one of the output lines 35. The output signal from the commutator 33 is applied to one of the trigger sources 38 to 40 to trigger the source into briefly energizing a corresponding one of the lamps 10 to 12. The energized lamp is momentarily turned on to illuminate the transparent character which is aligned therewith at the time of lamp energization. This illuminated character is visible through the corresponding one of the viewing windows 15 to 17.

The commutator 33 is automatically stepped to connect the succeeding one of its output lines to its input line after a trigger source has been enabled. The output signals from the trigger sources 38 to 40 are arranged to be short duration signals which provide an energization of the respective ones of the lamps 10 to 12 for the short interval during which the selected one of the characters 4 is in front of the lamps 10 to 12. Thus, the commutator 33 is effective to activate the trigger sources 38 to 40 in succession in response to coincidence signals from the comparator 30. The lamps 10 to 12 are briefly lighted to illuminate the selected ones of the characters 4. The selected display characters must be returned to their illuminated state during each successive rotation of the drum in order to provide a flickerless stroboscopic display utilizing the human persistence of vision. Thus, while the commutator 33 is automatically transferred to the next trigger source to await a new coincidence signal from the comparator 30 after each operation of the trigger sources 38 to 40, the preceding trigger sources must be reactivated during successive drum revolutions to display the selected characters.

Since the output signal from the commutator 33 is not available for reenergizing the previously enabled trigger sources, a secondary means for reactivating these trigger sources is provided within the drum 1. The first band of characters and associated elements will be used for the following example with the understanding that second and third character displays function in a similar manner. When the first lamp 10 is initially illuminated by the first trigger source 38 during the time that the selected first band character is aligned with first window 15, the light therefrom is also effective to stimulate that one of the phosphorescent material patches 41 located on the interior surface of the drum 1 adjacent to the selected character. The light from the stimulated patch is operative to produce an output signal from first photocell 42 located in the partitioned space with the lamp 10. This output signal is applied to the first trigger source 38 as an enabling signal therefor. Since the first trigger source 38 is currently active by the effect of the output signal from the commutator 33, the signal from the first photocell 42 has no effect at this time.

During the next revolution of the drum 1, the commutator 33 has been advanced to one of output lines 35 connected to the second trigger source 39. Accordingly, the commutator output signal is not available at this time to retrigger the first

source 38 when the first selected character is again aligned with the first window 15. The material used for the patches 41 continues to emit light for a period of time exceeding the time of one revolution of the drum 1. Thus, when the selected first character is again aligned with the first window 15, the corresponding one of the patches 41 is again adjacent to the photocell 42. The light from this previously stimulated patch is available to illuminate the photocell 42 at this time to produce the secondary enabling signal for the first trigger source 38. This signal is effective to reactivate the first trigger source 38 to momentarily light the first lamp 10. This light from the first lamp 10 is, in turn, effective to illuminate the selected one of the display characters 4 and to restimulate the adjacent one of the patches 41. This secondary enabling operation of the first trigger source 38 is repeated during each drum revolution. Thus, the selected first character is reilluminated on each rotation of the drum 1 to produce a flickerless display. Similarly, the second and third character displays are maintained after the input signals on the input terminals have disappeared. While the patches 41 have been illustrated in an arrangement wherein each patch is aligned with a corresponding one of the characters 4, it is obvious that the patches 41 can be associated with respective characters without being specifically aligned therewith. For example, the patches 41 may be offset with respect to the corresponding characters, i.e., either ahead or behind the characters. Alternatively, the patches 41 may be located in a different section of the drum 1 with light conducting elements, e.g., fiber optics, used to transmit light from the lamps 10 to 12 to the patches 41 to provide the aforesaid stimulation. Further, while the patches 41 have been illustrated as segments of phosphorescent material, it is obvious that any structure could be used which has the operative characteristic of storing an initial stimulation and, thereafter, providing an output signal indicative of a position on the drum 1 to furnish the aforesaid secondary triggering operation.

In order to terminate the aforesaid self-triggering display, the interrupt gate 46 is closed by a control signal applied to the input terminal 48. The closing of the gate 46 interrupts supply voltages for the trigger sources 38 to 40. Thus, the subsequent secondary enabling signals from the photocells 42 to 44 are ineffective to activate the lamps 10 to 12. The control signal is maintained for a period of time sufficient to allow the light output of the patches 41 to decay to level which is insufficient to produce the secondary enabling signals from the photocells 42 to 44. A new display of selected characters is initiated by removing the control signal from input terminal 48 and applying the coded input signals to the input terminals 31. It is to be noted that at this time the commutator 33 is in an initial, or "home" position to begin a new character display with the first display character.

Accordingly, it may be seen that there has been presented, in accordance with the present invention, an improved display means having a primary control means for initially displaying selected characters and a secondary control means for continuing a display of the selected characters independently of the primary means.

We claim:

1. A display means comprising a display medium having display characters thereon:

a memory element associated with each display character; illuminating means arranged to illuminate selected ones of said characters;

primary control means operative to initially trigger said illuminating means to display said selected characters;

means to actuate said associated memory element for said selected characters to indicate that said characters were displayed; and

a secondary means responsive to said actuated memory element to retrigger subsequently said illuminating means to display said selected characters independently of said primary control means.

2. In combination:

a display means comprising a plurality of display elements driven in succession past a viewing aperture and a plurality of light sensitive memory means, each corresponding to a display element, and driven in correspondence with said elements, each memory means having a storage time at least equal to the period between successive appearances of a given element at said viewing aperture;

means responsive to a source to signals for initially illuminating a selected element as it is positioned at said aperture and concurrently illuminating the light sensitive memory means corresponding thereto to thereby store therein an indication that its associated character has been illuminated; and

means responsive to said illuminated light sensitive memory means for subsequently controlling illumination of said selected element when it again passes said viewing aperture.

3. In combination:

a display means comprising a plurality of display elements and a memory means adjacent each display element, said elements being driven in succession past a viewing aperture;

means responsive to a source of external signals for initially illuminating a selected element as it is positioned in said viewing aperture and for concurrently activating the one of said memory means adjacent to said illuminated element; and

means responsive to said activated memory means for subsequently controlling illumination of said selected element as it is again driven past said viewing aperture.

4. In a display of the type in which a series of display elements move past a viewing aperture;

a plurality of light responsive memory means, each such means adjacent to a different display element;

stroboscopic illuminating means responsive to a selection signal for illuminating a selected one of said elements when it is in position at the viewing aperture and to illuminate at the same time the one of the light responsive memory means adjacent thereto; and

means responsive to said light responsive memory means adjacent to said selected one of said elements for subsequently activating said stroboscopic illuminating means to reilluminate said selected element when it next appears at said viewing aperture.

5. The combination of claim 4 wherein each light responsive memory means comprises a patch adjacent to its display element which in response to light excitation emits light for a limited interval of time, at least equal to that required for a selected character again to move past said viewing aperture, and wherein said means responsive to said memory comprises light sensitive means positioned adjacent said viewing aperture responsive to a patch which has been excited.

6. The combination of claim 5 further including interrupt means coupling said light sensitive means to said stroboscopic illuminating means and responsive to an external signal for preventing the detection of said illumination from said memory associated with said selected illumination means from activating said stroboscopic illumination means to prevent further displaying of said selected element.

7. In combination:

a storage medium formed with visible display elements thereon;

a display location;

drive means coupled to said medium for driving the same to cause said display elements to move in succession past said display location in a repetitive manner;

a plurality of light responsive memory means also coupled to said drive means, one such memory means corresponding to each such display element, the memory means being driven in correspondence with the display elements and each memory means having a storage time at least equal to the period between successive appearances of a display element at said display location;

means including a light source responsive to a selection signal for illuminating a selected display element called for by said signal, when said element is at said display location and for concurrently actuating the light responsive memory means for that selected element; and

means responsive to any memory means which has been actuated during the appearance of its display element at said display location for controlling the illumination of said display element the next time the same display element moves into said display location.

8. The combination is accordance with claim 7 wherein each said memory means is on said storage medium and is located adjacent to its display elements.

9. The combination in accordance with claim 7 wherein each memory means comprises a light emitting means.

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