PROGRAMMED ILLUMINATION OF PANEL DISPLAY SECTIONS

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ABSTRACT

The disclosure concerns control apparatus, usable for controlling information displays, and including a bi-stable mechanical switching device adapted to be set and re-set, and a programming element such as a sheet or drum movable between programming positions in which a shoulder or opening is selectively presented for controlling setting or re-setting of the switch device as the element is further moved in its programming position.

2 Claims, 13 Drawing Figures
PROGRAMMED ILLUMINATION OF PANEL DISPLAY SECTIONS
This is a divisional application of Ser. No. 803,807 filed Mar. 3, 1969 now U.S. Pat. No. 3,596,016.

BACKGROUND OF THE INVENTION
This invention relates generally to programming of information displays, and more particularly concerns control apparatus having unusually advantageous utility in such displays.

The invention herein described was made in the course of or under a contract or subcontract thereunder, with the Naval Training Device Center.

While in the past many different types of projected image displays have been constructed, none of them to my knowledge has incorporated the combinations and sub-combinations of unusual advantages in structure, mode of operation and result afforded by the present invention. Such advantages include the provision of a control system for a multiple projector display characterized in that the projectors are operated to project different images onto different portions of a screen or panel to make up an informative composite, the projection proceeding sequentially so that the composite changes in a logical sequence: the provision of a control system usable for that display, and wherein switches or equivalent elements are moved between and retained in different positions in response to advancement and switch actuating movement of a programming element, as will be described; and the provision of the referred to control system in a form characterized by extreme simplicity, high reliability and functional effectiveness.

SUMMARY OF THE INVENTION
Basically, and as regards the programmed illumination system, the invention contemplates the provision of a screen; multiple projector assemblies located to project sequences of images onto the screen to form a composite image; and control means including a group of switches respectively connected in controlling relation to the projector assemblies, switch actuating followers and a programming element having follower receiving stop shoulders and openings adapted to be advanced relative to the followers to a sequence of positions in each of which the element is operable to displace selected followers having a corresponding relation to the images to be projected onto the screen. In this regard, certain of the light projector assemblies include, in each assembly, a light projector, a series of image forming transparencies, and switch controlled drive structure operable to advance such transparencies for sequential presentation in the path of projected light.

Further, and as regards the control means, it may typically include, for each switch, a member (as for example a switch arm) alternately movable in first and second directions for opening and closing the switch; actuator structure including yieldable means through which force is transmitted to move the member in those directions; and holder means to controllably block and unblock movement of said member in those directions during such force transmission via the yieldable means. Typically, the actuator includes a yieldable element in the form of a spring, and a follower adapted to advance and retract and to transmit force to the spring. Further, programming means is operable to so move the follower in certain positions of the programming means, and to move relative to the follower in other positions of the programming means. As mentioned, the programming means includes structure (as for example a sheet or strip) forming follower receiving stop shoulders and openings arranged in a coded sequence.

Further, the programming means may advantageously include a coded sheet backer at the side of the sheet opposite multiple followers, there being one such follower for each coded sequence of stop shoulders and openings on the sheet; the backer may be cylindrical and have such interconnection with the sheet as to enable indexing advancement of the latter in response to backer rotation; and means may be provided to displace the programming means toward and away from the followers in order to operate selected followers in each indexed position of the coded sheet.

It is still another object of the invention to provide, in combination with a switch member having first and second positions and a programmer subject to progressive advancement, means including a follower located in such relation to the programmer as to effect operation of the switch member to first position and to hold that member in that position in response to bodily displacement of the programmer with the follower; and to effect operation of the switch member to second position and to hold that member in second position in response to bodily displacement of the programmer relative to the follower. Accordingly, programmer indexing relative to selective switch actuation may proceed in a simple and orderly manner, under positive mechanical control.

A further object is to provide a bi-stable mechanical switching device adapted to be set and re-set; and control means including a programming element having stop shoulders and openings, the element being movable in a first mode between programming positions in each of which a shoulder or opening is selectively presented for controlling setting or re-setting of the switch device, and the control means including the programming element being movable in a second mode relative to the switch device to effect such setting and re-setting thereof.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following description of the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWING
FIG. 1 is a front elevation showing the display screen; FIG. 2 is an enlarged elevation showing one preferred control system; FIG. 3 is an elevation taken in line 3—3 of FIG. 2; FIG. 4 is an elevation taken in section on line 4—4 of FIG. 2; FIG. 5 is a view like FIG. 4, but showing one stage of switch operation; FIG. 6 is a view like FIG. 4, but showing another stage of switch operation; FIG. 7 is a view like FIG. 4, but showing still another stage in switch operation; FIG. 8 is a view like FIG. 4, showing yet another stage in switch operation; FIG. 9 is a perspective showing of a programming sheet backer;
FIG. 10 is an enlarged view taken in section on line 10—10 of FIG. 1; FIG. 11 is a section taken on line 11—11 of FIG. 10; FIG. 12 is an elevation showing the mounting of the control means of FIG. 2 within the cabinet seen in FIG. 11; and FIG. 13 is an elevation showing in greater detail the switch described in FIGS. 3–8.

**DESCRIPTION OF PREFERRED EMBODIMENT**

Referring first to FIGS. 1 and 10, an upright screen, as for example a frosted glass panel, is shown at 10 mounted by a cabinet 11 having sections 11a and 11b which telescope into section 11c. The latter carries vertical frame members 12 and 13, which in turn mount multiple projector assemblies 14 located to project sequences of luminous images onto the screen to form an overall composite display. The light beams from the projector assemblies may or may not overlap, and are typically directed to different sections of the screen indicated in FIG. 10. Note in FIG. 1 that the multiple images at the display screen are oriented to have continuity horizontally and/or vertically, as is characteristic for example of flow diagrams or charts useful for instructional purposes. In accordance with a feature of the invention, one or more of the images at the screen may be changed at predetermined intervals to provide time sequencing of the display, as useful for instructional purposes.

Each assembly 14 includes a projector lens unit 14a, a series 14b of image forming transparencies, and a switch and control drive structure (as for example a motor) 14c operable to advance the transparencies for sequential presentation in the path of projected light. Light source 14d for the projectors are carried by uprights 13, as indicated, and fans 15 blow cooling air over finned housings for such sources.

Each series 14b of transparencies may comprise image forming slides or the like mounted in circular arrangement by a rotor 16 driven by the switch and control drive, so that successive slides may be indexed into the light path. In addition, 17 indicates a series of colored background forming slides or transparencies which may be motor rotated at 18 to control the background color at the screen 10. A vertically movable unit 19 (including transparency hopper 20 and projector 21) is mounted on a crossbar 22 which is vertically movable by a jack screw 23 motor driven at 24. The latter unit permits projection onto the screen of an image which may be moved relative to other screen images.

In accordance with an important aspect of the invention, control means is provided to include a group of switches respectively connected in controlling relation to the projector assemblies. In addition, the control means includes a group of switch-actuating followers, and a programming element having follower receiving stop shoulders and openings adapted to be advanced or indexed relative to the followers to a sequence of positions in each of which the element is then operable to displace selected followers having a correspondence to those images to be projected on the screen for that particular programmer position. Accordingly, as the programmer is indexed, selected groups of images are successively projected onto different portions of the screens, for instructional purposes.

Referring to FIGS. 4–8, a switch to control one of the motors 14c is shown at 25 as including an arm member 26 alternately movable in first and second directions (see for example FIGS. 6 and 8) for closing and opening the switch. Thus, arm 26 may have a contact 27 which upon upward movement (as for example rocking about a fulcrum 26a) engages switch fixed contact 28, and upon downward movement engages switch fixed contact 29, as also seen in detail in FIG. 13.

Actuator structure, generally indicated at 30, includes yieldable means such as spring 31 through which force is transmitted to move the arm member 26 in up and down directions, as referred to. The actuator structure may also be considered to include the follower rod 33, the rocking lever 50 pivoted on the switch terminal extension 51, and the over-center biasing spring 52 connected between lever 50 and arm 26 to move the arm up when lever 50 rocks upwardly, and vice versa. In addition, a holder 32 is provided to controllably block and unblock movement of the arm member 26 during force transmission via the spring. For example, the holder 32 in FIG. 5 restrains lever 50 from upward movement while follower 33 is lifted by programmer sheet 37 to compress spring 51 between follower 34 and lever 50; and in FIG. 6, the bell crank 35, which is pivoted at 36 and mounts the holder 32, is pivoted counterclockwise to effect holder release of lever 50, the arm 26 then being snapped upwardly upon release of the compressed spring 31 to snap lever 50 upwardly, thereby allowing biasing spring 56 to positively close the switch contacts 27 and 29, accomplishing setting of the switch. In this regard, pivoting of crank 35 is effected by engagement of a shoulder 39 on the programmer sheet lifter carriage 40 with the adjustment screw 41 on the bell crank. Further, the screws 41 on different of the cranks 35 associated with the groups of followers and switches may be adjusted so that the switches are actuated in predetermined and closely times sequence corresponding to pivoting of the crank arms.

Thereafter, when lifter shoulder 39 drops as in FIG. 7, the crank 35 pivots in clockwise mode under the pull of a return spring 98, and the holder 32 is swung under the lever 50 while spring 31 continues to exert upward force against lever 50. Also, lever 50 is restrained against downward movement as the follower 33 drops downward and imposes downward gravity loading on the lever via the spring 31. Later, when lifter shoulder 39 again rises (but relative to the follower due to follower penetration of the programmer sheet) the crank and holder are pivoted as in FIG. 8 to effect release of lever 50 for downward pivoting, whereby biasing spring 51 snaps contact arm 26 downwardly to positively engage contact 27 with contact 29. Accordingly, re-set of the switch is accomplished.

Auxiliary structure includes the electrical terminals 47, 48 and 49 respectively connected to contacts 27, 28 and 29; limits 54 and 55 to limit pivoting of the lever 50; an opening 56 in the lever 50 through which follower rod 33 projects; a frame member 57 supporting the switch 25 and having a guide opening 58 receiving the rod 33; and a frame member 59 carrying the pivot 36 for the bell crank 35.

Advantages of the above control means include provision for substantial motion reduction as between the relatively large upward displacement of the programmer sheet 37 and the small movement of the switch arm 26; selective operation of the switches as determined by the programmer sheet; and provision for program-
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FIGS. 2-8 illustrate the programmer sheet 37 as being in the form of a loop carried by backer cylinder 60 rotatable about axis 61, as for example in the direction of arrow 62 in FIG. 5. In this regard, the backer may carry two sets of sprocket teeth 63 meshing with holes 64 extending in columns at opposite ends of the sheet 37, whereby the sheet may be advanced in response to backer cylinder rotation. The sheet structure is such as to provide, at the intersections of columns and row lines (see for example column lines 65–68 and row lines 69–71), stop shoulders 72 and openings 73 arranged in coded sequence in such columns. Follower lower terminals engage the stop shoulders to be upwardly displaced (see FIG. 5) in certain positions of the programmer sheet during the switch setting mode, and the follower lower terminals are received in the openings 73 in other positions of the programmer sheet, so as not to be upwardly displaced (see FIG. 8), during the switch re-setting mode. Thus, the switches may be regarded as bi-stable mechanical devices subject to being set and re-set by the programmer sheet which may be advanced relative to the switches into different program-ming positions, and which may also be moved bodily relative to the switches (in an achieved program-ming position) to secure their actuation.

The backer cylinder 60 typically has holes 75 underlying all the stop shoulders and openings at all the column and row intersections, such holes being sized to receive the follower rods as seen in FIG. 8.

Row-to-row indexing of the backer cylinder is effected by means now to be described, and as seen in FIGS. 2, 3 and 12.

Another aspect of the invention concerns the provision of means to effect dual mode movement of the programmer sheet on the backer, in relation to the switch or switches, as described above. In the illustrated embodiment the backer cylinder is supported at 80 and 81 and on carriage 40 for rotation, there also being a knob 81 projecting at the side of the carriage to secure manual rotation of the cylinder. The carriage is in turn suspended by links 82 which move up and down to lift and lower the carriage, as described. Guide rods 83 are received in openings in the carriage top plate 84, and extend vertically to guide vertical reciprocation of the carriage. Compression spring 86 on rods 83 continually urge the carriage downwardly and against lifting force exerted by links 82. Rods 83 are attached at 87 to the frame 88, to which a pawl 89 is pivotally attached at 90. The pawl terminal 89a engages teeth 63 on one sprocket when the carriage is lowered sufficiently to free the programmer sheet from the followers 33, whereby the sprocket is indexed to bring the next row of stop shoulders and openings in the sheet beneath the rods 33.

Lifting and lowering of the links 82 is effected by a rotary drive that includes motor 90, gear train 91, cross-shaft 92, and crank rotors 93 to which links 82 are eccentrically connected at 94. The motor is intermittently operated under the control of a switch 95, as seen in FIG. 2, the operation being sufficient to cycle the carriage once for each depression of the push-button 96 on switch 95.

Sheet 37 may be relatively stiff, and may for example consist of metal for durability as respects its functioning to lift the followers as described. Sheet 37 might also consist of punched paper (stiff) and might be formed as a drum.

I claim:

1. In combination with a screen, multiple switches and multiple projector assemblies connected to be controllable by said switches so as to project sequences of images onto the screen in response to sequential operation of the switches, the combination for each switch of a member alternately movable in first and second directions for closing and opening the switch, b. actuator structure including yieldable means through which force is transmissible to move said member in said directions, said actuator structure including a follower adapted to advance and retract and to transmit force to said yieldable means, and c. holder means to controllably block and unblock movement of said member in said directions during said force transmission via said yieldable means, and including pro-gramming means to advance selected followers in certain positions of the pro-gramming means and to move relative to selected followers in other positions of the programming means.

2. The system of claim 1 wherein certain of said projector assemblies include, in each assembly, a light projector, a series of image forming transparencies, and switch controlled drive structure operable to advance said transparencies for sequential presentation in the path of projected light.