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(54) SLIDE PROJECTOR AND MAGAZINE THEREFOR

(71) We, GAF CORPORATION, a corporation organized and existing under the laws of the State of Delaware, United States of America, having its main office at 140 West 51st Street, City, County and State of New York, 10020, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a slide projector and in particular to a slide projector arranged to have a slide magazine mounted thereon and to project slides from the magazine singly and sequentially, each slide being withdrawn from the magazine, projected, and then returned to the magazine.

A magazine and slide projector of this kind is described in Patent Specification 1,162,592 in the name of GAF Corporation to which attention is drawn in view of the provisions of Section 9 of the Patents Act 1949.

The present invention provides a slide projector having an upper wall on which a slide magazine can be mounted for movement forwardly and reversely over the upper wall to present slides contained in the magazine singly and sequentially over an aperture in the upper wall registering and communicating with a projector gate in the projector to allow the slides to pass between the magazine and the projector gate, means within the projector to lower the slides from the magazine into the projector gate for projection and to return the slides to the magazine after projection, and indexing means for engagement with indexing projections on the slide magazine to move the magazine forwardly and reversely over the aperture in timed sequence with the projection of the slides, the indexing means including an indexing gear for engagement with the projections when the magazine is operatively mounted on the projector, an indexing member having forward and reverse teeth alternatively engageable with the gear in response to shifting

of the member between forward and reverse positions, shifting means connected with the indexing member for moving the indexing member back and forth between said positions, actuating means connected with the indexing member for moving the same through an indexing cycle, and indexing locking means comprising, a locking member having at least one tooth arranged to engage the indexing gear for locking the gear, the locking member being mounted for movement between a locked and an unlocked position, and spring means connected to the locking member and to the actuating means for yieldably moving the locking member to its locked position, the actuating means including an element engageable with the locking member for positively returning the locking member to its unlocked position.

The invention will be better understood from the following description and the accompanying drawings, in which:

Fig. 1 is a perspective view of a slide magazine and slide projector incorporating the present invention;

Fig. 2 is an enlarged section taken generally along the line 2—2 of Fig. 1;

Fig. 2A is a section taken along line 2A—2A of Fig. 2;

Fig. 3 is a section similar to Fig. 2 (except the slide magazine and certain parts of the projector are not illustrated) primarily showing the slide-releasing means, the expandible and contractable projection gate, and the cam means for operating these components;

Fig. 4 is a perspective view of a sub-assembly primarily consisting of the slide changing mechanism;

Fig. 5 is a section similar to Fig. 3 primarily showing the shutter mechanism and the slide-indexing means;

Fig. 6 is a section taken generally along the line 6—6 of Fig. 1 and primarily showing the magazine latch, the disabling means associated with the slide-indexing mechanism, the manual operating member or "Load" button and related linkage;

Fig. 7 is a fragmentary bottom plan

view as seen looking at the underside of the top wall portion of the projector housing and showing the indexing mechanism, the magazine latch and the linkage associated with the disabling means;

Fig. 8 is a perspective view as seen looking upwardly at the underside of the top wall of the projector housing and showing the indexing mechanism;

Fig. 9 is an exploded perspective of the main components of the slide-indexing mechanism;

Fig. 10 is a schematic drawing showing the electrical system in the projector.

The slide projector of this invention, generally designated as 34, includes a box-like housing or casing defined by four side walls 35 which join with the top wall 29. The housing has a bottom wall 36. The projector includes the usual means (not shown), i.e., a lamp and a number of lenses, defining the projector optical axis 37 (Fig. 2). Such means are not described herein as they are of well-known construction and of themselves form no part of the present invention. Mounted within the projector housing in a fixed position and in a plane perpendicular to the optical axis 37 is a partition plate 38 which extends completely across the housing between opposite side walls 35. This partition plate has a rectangular opening 38a (Fig. 5) forming part of the projection gate. As best noted in Figs. 2 through 4, the projection gate is further defined by a vertically disposed slide guide 39 having a vertically extending groove 39a (Fig. 2A) for slidably receiving one side edge of a photographic slide mount. It will be understood that the guide 39 is fixedly mounted by the partition plate 38. The projection gate has another vertically extending slide guide 42 which is mounted on a plate 43. The plate 43 is supported on the partition plate 38 for limited horizontal reciprocal sliding movement relative thereto by suitable means, such as a slot 43a in the plate slidably engaging a fastener 44 supported by the partition plate 38 and by a tab 38b which slidably engages the underedge of the plate 43. From Fig. 2A it will be noted that the slide guide 42 includes a vertically extending groove 42a for slidably engagement with a side edge of a photographic slide mount. Movement of the slide guide 42, by corresponding movement of its supporting plate 43, serves to expand and contract the projection gate for respective releasing and gripping of a slide by reason of an inclined surface 42b and a projection 42c as will be explained in greater detail below. It should be noted that the plate 43 includes a generally rectangular opening 43b.

The projector includes an electric motor (shown only schematically in Fig. 10 and

designated 45) of known construction; this motor, through the medium of a solenoid operated clutch (also shown only schematically in Fig. 10 and designated 46a), drives a shaft 46 and a cam 47 eccentrically mounted thereon, the cam having a circular cam track 47a. The partition plate mounts a pin 48, which pin pivotally engages one end of a slide-lifting lever 50. Lifting lever 50 includes a rectangular opening 51 having bent flanges 51a, 51b at its respective upper and lower edges, which flanges are slidably engaged by the cam surface 47a. It should be apparent that when the cam 47 has been rotated from its solid line position to its phantom line position (Fig. 2), i.e., upon rotation of the shaft 46 through 180°, the arm 50 will be moved from its solid line position shown to its phantom line position illustrated in Fig. 2. The lifting lever 50 includes a foot 52 arranged to engage a bottom of a slide for lifting the latter from the projection gate and returning the same to its slide-receiving space formed between the radially extending partitions 15 of the magazine 10. The partitions 15 have a flat portion 15a extending across the outer corner thereof. The magazine 10 has concentric inner and outer walls 12 and 14.

Referring now primarily to Fig. 3, the shaft 46 mounts another cam 54. This cam has a circular cam surface 54a interrupted by a recessed cam surface 54b and an adjacent cam lobe 54c. The partition plate 38 supports a pin 56 which in turn pivotally supports a rocker arm 57. This rocker arm has a depending leg 57a which carries a cam follower 58, the latter being arranged to be engaged by the various cam surfaces of the cam 54. The other leg 57b of the rocker arm includes a small aperture engaged by one end of a coil spring 59, the other end of this spring being connected to the tab 38b formed integrally with the partition plate 38. It should be readily apparent that the spring 59 urges the rocker arm in a counterclockwise direction for maintaining the cam follower 58 in engagement with the cam surface on the cam 54. From Fig. 3, it will be understood that the lowermost end of the leg 57a is arranged for abutting engagement with a flange 43c bent at a right angle from an extension 43d of the plate 43 of the actuating plate. A spring 60 has one end thereof connected to a tab 43e on the plate 43 and the other end thereof connected to a tab 38c struck from the partition plate; this spring urges the plate 43 to the right for maintaining the cam following tab 43c in engagement with the end 57a of the rocker arm during a portion of movement of the latter. As noted in Fig. 2, the tab 38c also serves as a stop against movement of the plate 43 to the right. The purpose

of this construction will be explained hereinbelow. It will be observed that leg 57a of the rocker arm includes an opening 57c. This opening adapts the rocker arm 57 to operate the shutter as will be explained hereinbelow.

The partition plate 38 mounts a pin 64 (Fig. 5); this pin pivotally mounts an arm 65 adjacent the side of the partition plate opposite the side thereof against which the rocker arm 57 is mounted. The upper end of arm 65 is pivotally engaged with one end of a stiff wire 66, the other end of this wire being pivotally received in a small aperture formed in a shutter plate 68. The shutter is pivotally mounted about a pin 69, this pin being supported by the partition plate 38. The arm 65 has an integral tab 65a extending at a right angle to the plane of the former; this tab is engaged by one end of a coil torsion spring 71. The other end of this spring is received in an opening 72 formed in the partition plate 38. It will be understood that the spring 71 tends to urge the shutter 68 to its closed position. The arm 65 carries a pin 73 which is received in the opening 57c of the rocker arm thereby to control movement of the shutter against the force of the spring 71; this will be explained in greater detail herein. The partition plate 38 has a slot 74 therein to accommodate movement of the pin 73.

Returning now to Fig. 2, the partition plate 38 supports a pin 75 which slidably and pivotally mounts one end of a slide-releasing arm 76, the latter being provided with a slot 76a which receives the pin 75. A coil spring 77 (Fig. 4) has one of its ends biased against the adjacent inside housing wall 35 and the other of its ends biased against the inside surface of the web of the arm 76 which is generally U-shaped in horizontal cross-section. It will be appreciated that the spring 77 acts to urge the slide-releasing arm 76 in a clockwise direction about the pin 75. Movement of the arm 76 is limited in this direction by the engagement thereof with an inclined surface 42b on the slide guide 42.

It will be observed that the slide-releasing arm 76 has an upper end 76b which extends upwardly through one end of a slot 29a formed in the top projector wall 29; this slot is arranged over the projection gate defined by the guides 39, 42, etc.

The items described in detail in the foregoing description do not form part of the present invention but are described in detail to enable a better understanding of the invention and its relation to the entire projector.

As best noted in Figs. 2 through 4, an elevating member 80 engages the releasing arm 76 for lifting the latter at the proper time to enable the end 76b of the releasing

arm to engage and deflect one of the spring fingers 23c for releasing a slide as will be explained hereinbelow. The elevating member 80 is a generally right angle shaped member having a tip 80a arranged to engage the lower end of the slide-release arm 76. The other end of the elevating member 80 is pivotally mounted about a pin 81, the latter being suitably mounted from the partition plate 38. The elevating member carries a cam following pin 82 positioned to be engaged by an inclined cam surface 84 formed integrally on one end of a cross-bar 85.

The cross-bar 85 is mounted for reciprocal sliding movement transversely of the projector. This is achieved by slidably resting one end of the cross-bar 85 on a suitable slide 86 mounted on the bottom 36 of the projector housing and by providing the other end of the cross-bar 85 with an open ended slot 87 slidably receiving a fastener 88, the latter being mounted from the partition plate. The cross-bar includes an upstanding portion 85a mounting a cam follower in the form of a roller 90, the latter being adapted to be engaged by a cam 91 mounted on the shaft 46 behind the cam 54. The cam 91 includes an arcuate cam surface 91a joining with a cam lobe having a cam surface 91b. The partition plate 38 mounts a pin 93 supporting a coil spring 94 having opposite ends thereof received in respective apertures in the partition plate 38 and cross-bar 85 for biasing the latter to the left thereby holding the cam follower 90 in engagement with the cam surfaces on the cam 91. It will be understood that when cam surface 91b comes into engagement with the cam follower 90, the cross-bar 85 is shifted to the right thereby bringing the cam 84 into engagement with the cam follower 82 and rocking the elevating member 80 in a counterclockwise direction about the supporting pin 81 for lifting the slide-releasing arm 76 to allow the upper end 76b thereof to contact the lower end 23b of one of the spring fingers in the magazine.

Referring now to Fig. 5, it will be observed the shaft 46 mounts another cam 96, the latter being eccentric with respect to the shaft and including a circular cam surface 96a. An indexing mechanism operating plate 97 is mounted adjacent one side of the partition plate 38 for horizontal reciprocal movement relative to the latter. To this end, the plate 97 includes oppositely disposed open ended slots 98 slidably receiving fasteners 99 supported by the partition plate. The operating plate 97 includes a square opening 100, the opposite side edges thereof being defined by flanges 101 which are bent from the plate 97 at a right angle thereto and which engage the circular cam surface 96a. It will be understood the cam

96 is not contained within the opening 100 but is disposed adjacent one side of the plate 97 in engagement with the flanges 101 whereby the plate 97 is imparted with horizontal reciprocal movement in response to rotation of the cam 96 during corresponding rotation of the shaft 46. It will be observed the operating plate 97 includes an upwardly extending tab 102; this tab serves to operate the slide-indexing mechanism as will be explained below.

Fig. 4 shows the entire slide changing mechanism mounted as a sub-assembly. The shaft 46 carries a gear 104 which is in meshing engagement with a pinion gear (not shown) forming part of the drive from the electric motor in the projector. As mentioned above, the shaft 46 is driven by the motor 45 through the medium of the solenoid actuated clutch 46a.

The partition plate 38 carries another plate 106, the latter being mounted in parallel spaced relation with the partition plate by means of fasteners 107 and spacers 108. The plate 106 mounts a "Full Cycle Park Switch" 110 which is a so-called blade switch and which is biased open. Similarly, the plate 106 mounts a "Half Cycle Park Switch" 112 which is also a blade switch and which is biased closed. The gear 104 carries a lobe 114 for engaging the blade portion 110a thereby to bias switch 110 closed momentarily once during every full revolution of the gear 104. Similarly, the gear 104 includes another cam lobe 115 for engaging the blade portion 112a to bias the switch 112 momentarily to the open position once every revolution of the gear 104. It will be observed the switches 110, 112 and the actuating lobes on the gear 104 are spaced at different distances radially of the latter thereby to insure that each switch is actuated only once for every one revolution of the gear.

As noted in Fig. 2, the teeth 30 on the slide magazine 10 are in meshing engagement with an indexing gear 118, the latter being rotatably mounted in a cavity 119 formed in the top wall 29 of the projector housing. The gear 118 includes a central hub portion 120 extending downwardly through a central opening 121 in the cavity 119, such hub portion 120 mounting another gear 122. It will be understood the gears 118, 122 are connected together for rotation in unison.

Referring now primarily to Figs. 2, 5, 8 and 9, the indexing mechanism includes a bracket plate 124 mounted in parallel spaced relation beneath the projector top wall 29 by means of a pair of fasteners 125, associated spacers 126, and by a further fastener 127 extending through a collar 128 and threadingly engaged in a suitable central aperture formed in the hub 28. As

noted in Fig. 9, the bracket plate 124 includes a pair of openings 130 for receiving the fasteners 125, and another opening 131 for receiving the fastener 127. Further, the plate 124 includes an aperture 132 which receives the lower end of a pin 120a serving to connect the gears 118 and 122 together. Finally, the plate 124 includes a rectangular opening 134 the purposes of which will be explained hereinbelow.

Slidably mounted on the upper surface of the bracket plate 124 is an indexing plate 136, the latter including integral indexing dogs 137, 138 for alternate engagement with the teeth of gear 122 to rotate the latter in either direction. The plate 136 also includes downwardly extending, integral tabs 139 which alternately abut opposite side edges of the bracket 124 to limit horizontal or lateral shifting movement of the indexing plate 136. The plate 136 also includes an elongated opening 140 for slidably and rotatably receiving hub 128. A generally rectangular opening 141 is formed in the indexing plate, one edge of this opening, 141a, being slightly arcuate in shape. A transversely extending slot 142 is formed in the end of the indexing plate 136 which is adjacent the opening 140. The indexing plate also includes an integral tab 144, the latter being stepped downwardly from the main body portion of the plate 136 and being provided with a slot 144a to receive one end of a stiff wire 145 (Figs. 7 and 8).

Mounted immediately above the indexing plate 136 is an actuating plate 147. This actuating plate includes an elongated slot 148 of the same size and shape as the opening 140 in the plate 136. The opening 148 slidably and rotatably receives the hub 128. The actuating plate 147 also includes an opening 149 snugly receiving one end of a pin 150, the latter extending freely into the slot 142 in the indexing plate 136. The plate 147 includes an extended portion 147a defining a catch 152. The extended portion 147a also mounts an integral, upstanding tab 153. Finally, the actuating plate 147 includes a laterally extending integral tab 154 having a recess 154a for receiving one end of a coil spring 156 as best seen in Figs. 7 and 8.

Mounted above the actuating plate 147 in vertical spaced relation therewith is a locking plate 158. This plate includes an elongated opening 159 slidably and rotatably received in an annular groove 128a (Fig. 6) formed in the hub 128 above an enlarged portion 128b. The plate 158 also includes an integral, downwardly extending tab 160 having a recess 160a for receiving the other end of the spring 156. The locking plate further includes a longitudinally extending, rectangular slot 161 and a longitudinally extending, open ended slot 162, the latter 130

slidably receiving a centering pin 163 suitably supported from the underside of the projector wall 29 as noted in Figs. 2 and 5. The locking plate includes a pair of locking teeth 164 adapted for locking engagement with the teeth on gear 122 as best seen in Fig. 7. Finally, the locking plate 158 includes a pair of downwardly extending, integral tabs 166 which engage the upper surface of the indexing plate 136 for holding the latter and the plate 158 in parallel spaced relation.

The gear 122 is rotated in either direction upon actuation of the indexing mechanism depending on whether the indexing plate 136 is positioned for bringing the dog 137 or the dog 138 into engagement with the teeth of this gear. The indexing plate 136 is shifted back and forth between "forward" and "reverse" positions by an overcenter linkage arrangement, generally designated 168, which arrangement is connected to the wire 145, which is actuated by a solenoid 169.

It will be understood that by reason of this overcenter linkage arrangement and the connection of the wire 145 to the indexing plate 136, the latter will be disposed or cocked to either side of the bracket plate 124. Solenoid 169, which controls the over-center linkage assembly 168, is of course operated by a suitable "forward-reverse" control member (not shown) on the projector housing.

The operation of the slide indexing mechanism is as follows: At the outset, it should be stated that the operating tab 102 on the cam-operated plate 97 extends through openings 134, 141 and 161 in respective plates 124, 136 and 158. Further, the actuating plate 147 is positioned such that the catch 152 is located to be engaged by the tab 102 upon movement of the plate 97 to the right. Assume that the overcenter linkage assembly 168 has been actuated for positioning the index plate 136 as illustrated in Fig. 7 wherein the dog 138 is positioned for engaging the teeth on the gear 122. Assume also that the teeth 164 and the locking plate 158 are engaged with the teeth on the gear 122 for locking the latter, thereby to lock the slide magazine against rotation, as will be the case when the slide is being projected in the gate.

When a slide changing cycle is initiated, as will be explained more fully hereinbelow, the plate 97 will be in a center position, i.e., at the midpoint of its horizontal stroke, and will commence moving to the left thereby imparting corresponding movement to the tab 102. This tab will engage the end 161a of the slot 161 thereby shifting the locking plate 158 to the left, i.e., to its unlocked position, thereby withdrawing the teeth 164 from the teeth of the gear 122.

During movement of the tab 102 to the left, the same will also strike the edge 141a of the indexing plate 136 thereby also to withdraw the same slightly to the left for positioning the dog 138 to engage a successive tooth on the gear 122.

As the slide changing cycle continues, the tab 102 commences movement to the right. Just prior to the time the tab 102 returns to its center position described above, the same strikes the catch 152 on the actuating plate 147. Since the actuating plate is positively connected to the indexing plate 136 by reason of the pin 150, the indexing plate will commence moving to the right for bringing the dog 138 into engagement with a successive tooth on the gear 122 thereby imparting counterclockwise rotation (Fig. 7) to the latter. This movement to the right of the actuating plate 147 will also cause corresponding movement to the locking plate 158 by reason of engagement of these two plates via spring 156. Initially, the locking teeth 164 will contact the teeth outer surfaces 122a and will not enter the spaces between the teeth until the gear 122 has been indexed through an arcuate amount which equals 360° divided by the number of teeth on the gear. This arcuate amount is such that the slide magazine is indexed or rotated an amount for bringing a successive slide-receiving space over the projection gate. As noted in Fig. 7, detent means in the form of a spring bar 170 are provided for detenting the gear 122 after every such increment of arcuate movement. After indexing has been completed, the tab 102 will commence movement to the left and will return to its center position. This final leftward movement of the tab does not bring about actuation of the indexing mechanism or the locking mechanism because of the lost motion connections defined by the tab 102 and the plate openings 141, 161.

Means are provided for releasably latching the slide magazine in its place on the top of the projector housing. Referring now to Figs. 6 through 8, such means include a latch member 172 pivotally mounted intermediate the ends thereof on a pin 173, the latter being appropriately mounted from the underside of the top wall 29 of the projector housing. The latch includes a generally hooklike portion 174 having a stepped-up end extending through an opening 29b in the projector wall and being received within a cavity 28a in the hub 28. This stepped-up end of the catch includes a finger 175 which, when the latch 172 is in one position thereof, overlies the magazine flange 26 thereby to prevent separation of the magazine from the projector. The other end of the latch 172 includes an open

ended slot 176 receiving a tab 177 integral with a plate 178.

As noted in Figs. 6 and 7, the plate 178 is elongated and extends horizontally toward one corner of the projector housing. The plate 178 is provided with an opening (not shown) receiving one end 180a of a pivot arm 180. This arm is pivotally mounted on a pin 181, the latter being suitably mounted from a bracket 182 in turn connected to a right angle bracket 183. This last mentioned bracket is fixedly mounted in the projector housing. The arm 180 has its other end 180b received in an opening (not shown) formed in a vertically extending bar 185 which has the upper portion thereof offset and mounting a "Load" button 186. It will be understood that suitable means are provided for mounting the bar 185 for limited vertical reciprocal movement. Spring means (not shown) are preferably provided to urge the bar 186 to the up position. It should be apparent that when the "Load" button 186 is depressed, as by the operator's finger, the bar 178 will be shifted to the right (Fig. 6) for rotating the latch 172 to withdraw the finger 175 from its position overlying the magazine flange 26 thereby permitting removal of the magazine from the projector and mounting of the magazine on the projector.

It will be noted the plate 178 includes another flange 188 which is positioned for striking the tab 153 on the actuating plate 147. When the "Load" button 186 is depressed for withdrawing the tray latch as just described, the flange 188 strikes the flange 153 and cocks the actuating plate 147 so the catch 152 thereof will not be engaged by the operating tab 102. This results in disabling the indexing mechanism. This disabling of the normal indexing gear 118 meshing with the teeth 30 of the magazine is desirable when an auxiliary device for random selection of slides for projection having a separate gear engaging with the teeth 31 on the magazine 10 is used.

As noted in Fig. 6, the bracket 183 mounts three blades 190, 191 and 192 defining in effect two pairs of electrical contacts. To this end, the blades 191 and 192 mount respective contact buttons 191a and 192a which are normally closed. The blade 191 has a bent upper end 191b which is normally spaced from the blade 190. The bar 185 carries a wedge member 194. When the "Load" button 186 is depressed, the wedge 194 comes between the blades 191, 192 thereby opening the contacts 191a, 192a, and substantially simultaneously bringing the blade end 191b into contact with the blade 190 and thereby establishing electrical contact between the blades 190 and 191. The operation of the two sets of contacts defined by the three blades 190, 191 and 192

will become apparent from the following description of the electrical schematic of the projector.

Turning now to Fig. 10, the lines from a suitable power source, such as 117 V.A.C., are designated 196 and 197, the former being connected to a contact 198 associated with a Main Power Switch 199 having an actuating member 200. The other line 197 is directly connected to the windings 45a of the motor 45. The switch 199 includes a "Fan" terminal 201, the latter being directly connected to the winding of the motor 45 and also to one terminal of a socket 202 arranged to receive an attachment for random selection of slides for projection when such is used. The switch 199 includes another terminal 204, which may be termed as the "Lamp" terminal, this terminal being connected through the projector lamp 205 to the other line 197 and also to one of the terminals in the socket 202. It will be understood that when the switch actuating member 200 is moved to the "Fan" position for bridging the contacts 198, and 201, power will be supplied to the motor 45 which operates, among other components, the usual cooling fan (not shown). When the actuating member is moved to the "Lamp" position thereby bridging the contacts 198, 201 and 204, the motor 45 will remain energized and the lamp 205 will also be energized. When the actuating switch member is in this position, power is also applied to the Random Access Socket 202.

One of the motor windings 45b is tapped as at 206 so as to provide approximately 28 V.A.C. for powering the various components of the projector to be mentioned hereinbelow. The tap 206 is connected to a solenoid 207; this solenoid operates the clutch 46a which drives the shaft 46 from the motor 45. It will be noted the solenoid 207 is connected to terminals of the Half Cycle Park Switch 112, which is biased to the open position, and to the Full Cycle Park Switch 110, the latter being biased to the closed position.

The following referred to projector components which are illustrated schematically in Fig. 10 form no part of the present invention and are mentioned only for purposes of completeness of disclosure. The winding 45b is center tapped, as at 209, thereby to provide approximately 6 V.A.C. for powering a focus motor 210. The focusing motor 210 is connected to on terminal 212a of a socket arranged to receive a remote control device of known type. Other terminals 212b, 212c and 212d of the socket 212 are respectively connected to the "forward-reverse" solenoid 169, to the blade contact 191, and to the terminals of the switches 110, 112 and solenoid 207. A so-

called "defeat" switch is represented at 214 which comes into play only when the device for random selection of slides for projection is attached. The projector timer generally designated 215, may conveniently be a thermally responsive or bimetal timer member. A complete slide changing cycle, i.e., slide changing and indexing, is commenced either by actuation of the timer or by actuating a "Cycle Switch" (not shown) which bridges terminals 212c and 212d.

The operation of the projector and magazine according to the present invention is as follows: Assume the switch actuating member 200 is in the "Lamp" position and assume further that a slide is being projected in the gate. Under these conditions, the slide-fitting arm 50 and the slide-releasing arm 76 will be in the positions illustrated in Fig. 2, and the shutter 68 will of course be in the open position as indicated in phantom lines in Fig. 5. The "Load" button 186 will be in its up position, and the arrangement of the various switches will be as indicated in Fig. 10.

The slide changing mechanism is operated during a complete slide changing cycle, of course, and also whenever the "Load" button 186 is depressed. The operation of the projector will first be explained herein in conjunction with operation of the "Load" button 186 for mounting a loaded magazine on the projector.

The "Load" button 186 is momentarily depressed for withdrawing the latch finger 175 thereby to permit mounting of the magazine. As this movement of the "Load" button establishes contact between the contact blades 190 and 191, it will be seen that the solenoid 207 is energized through the normally closed Half Cycle Park Switch 112. Energizing the solenoid 207 brings the clutch 46a into operation thereby to cause rotation of the shaft 46 in a clockwise direction as shown in the various figures. As the gear 104 commences to rotate, the lobe 114 will separate from the blade end 110a of the Full Cycle Park Switch allowing the latter to snap to the closed position almost immediately.

The aforementioned rotation of the shaft 46 causes clockwise rotation of the cam 47 thereby commencing upward movement of the lifting arm 50 by reason of the engagement of cam surface 47a with the flanges 51a, 51b. Normally a slide will not be in the gate at this time.

During this initial movement of the shaft 46, corresponding rotation will be imparted to the cam 54 thereby to swing rocker arm 57 in a clockwise direction about its supporting pin 56. This movement of the rocker arm will allow movement of the shutter pin 75 thereby to permit the spring 71 to swing the shutter arm 65 to the left

for swinging shutter 68 to the closed position indicated in broken lines in Fig. 5.

When the shaft 46, and the various cams carried thereby, have rotated through approximately 180° or a half cycle, the lifting arm 50 will have been swung to its uppermost position, the shutter will remain closed (further clockwise swinging movement of the rocker arm has no effect on the shutter pin 73 because of the lost motion connection resulting from the opening 57c being much larger than this pin), and the operating plate 97 will have shifted from the so-called initial or center position, to the limit of its movement to the left and will then have moved to the right returning to the center position. The initial movement of the tab 102 to the left from its center position will result in fully withdrawing the locking plate 158 from the teeth on the indexing gear 122. During this movement of the plate 97 to the right, the tab 102 on the operating plate will not come into engagement with the catch 152 since the "Load" button is down thereby holding the plate 147 in its position for disabling the indexing means. As soon as the lobe 115 on the gear 104 opens the Half Cycle Park Switch 112, the solenoid 207 will be de-energized. Although the Full Cycle Park Switch 110 will be closed at this time, it does not serve to energize the solenoid 207 since the contacts 191a, 192a will be separated as the "Load" button is in its depressed position.

When the "Load" button is released and allowed to pop up, the contacts 191a, 192a are allowed to close thereby energizing the solenoid 207 through the closed Full Cycle Park Switch 110. As the shaft 46 continues to rotate, the plate 97 will continue its movement to the right by reason of the action of the cam 96 on the shaft 46. When the "Load" button is released, the plate 147 will have been allowed to return to its normal position. However, at this time tab 102 will have already passed the position adjacent the catch surface 152 and therefore the indexing means are not placed into operation upon release of the "Load" button. During this continued movement of the shaft 46, the lifting arm 50 commences to lower. As the shaft 46 continues to rotate, the cam surface 54c begins to come into engagement with the surface 58 of the rocker arm 57, thereby bringing the latter into engagement with the flange 43c of the plate 43 thereby to shift the slide guide 42 to the left to open the gate for reception of a slide. This movement of the slide guide 32 commences the swing to slide-release arm 76 to the left by reason of the engagement between the latter and the inclined surface 42b on the slide guide 42. During this same period of time, the cam lobe 91b

on the cam 91 comes into engagement with the cam follower 90 thereby to shift the cross-arm 85 to the right for commencing lifting movement of the elevating member 80. This member forces the slide-releasing arm 76 upwardly where the upper end 76a thereof will be in a position to contact the end 23b of the spring finger which is disposed over the projection gate. The end 76b of the releasing arm will not come into engagement with the spring retaining finger in the slide magazine until the magazine has been fully indexed and locked in proper position by engagement of the locking teeth 164 with the teeth on gear 122. Shortly after this occurs, the slide-releasing arm 76 will have been elevated to its uppermost position. Then, the cam surface 54c causes further or final leftward movement of the plate 43. This action brings the slide guide projection 42c into engagement with the slide-releasing arm 76 thereby imparting final swinging movement of the latter to the left for shifting or biasing one of the spring fingers 23a to the left thereby to release the slide and allow the same to drop into the expanded gate. At this time, the lifting arm 50 will be near its lowermost position. As the shaft 46 completes its full revolution, the cam 54 will be positioned such that cam following surface 58 on the rocker arm 57 will be allowed to be received in the recess 54b of the cam thereby causing the trailing edge of the opening 57c to contact shutter pin 73 and open the shutter against the force of the spring 71 and also allowing the gate to contract, i.e., the slide guide 42 to shift to the right for gripping the slide. This movement of the slide guide 42 also allows the spring 77 to return the slide-releasing arm to the right, i.e., the position illustrated in Fig. 2. This final movement of the shaft 46 also positions the cam 91 such that the cross-arm 85 is allowed to return to the left under the influence of the spring 94 whereupon the elevating member 80 is lowered allowing the slide-release arm 76 to be lowered completely within the slot 29a as shown in Fig. 2. During this final one-half cycle, the tab 102 on the plate 97 will have shifted to its limit of movement to the right and then will have moved to the left returning to the so-called center position mentioned above. A slide will now be positioned in the gate for projection, and the various parts will be disposed for commencing another cycle of operation as just described.

During a complete slide changing cycle, which is brought about either by operation of the timer or by actuation of the "Cycle Switch" (not shown) which bridges the contacts 212c, 212d, the "Load" button is not depressed and therefore the contacts 191a

and 192a remain in engagement. During a complete slide changing cycle, assuming such cycle is initiated by bridging the contacts 212c, 212d, it will be seen that the solenoid 207 will be energized and a slide changing operation will be commenced as explained above. The contacts 212c, 212d are bridged only momentarily, but when opened the solenoid 207 will continue to be energized because at that time the Full Cycle Park Switch 110 will be closed. The only difference in the cycle of operation from that explained above will be that the indexing mechanism will be brought into operation. As the tab 102 moves to the right and approaches its center position, it will engage the catch 152. Continued movement of the tab 102 to the right during the final 180° movement of the shaft 46 will cause the dog 137 to be brought into engagement with one of the teeth on the indexing gear 122 thereby indexing the magazine to position the next slide-receiving space therein over the projection gate. After this next slide-receiving space is positioned over the gate, the slide-releasing arm 76 then comes into operation for releasing the slide allowing the same to drop into the expanded gate. It will be appreciated that during a cycle of operation initiated either by bridging the contacts 212c, 212d or by operation of the timer, opening and closing of the Half Cycle Park Switch 112 serves no purpose.

When the device for random selection of slides for projection is used, the "Load" Button 186 is mechanically held down until the selected slide space is positioned over the projection gate. Therefore, when the lobe 115 on the cam comes into engagement with the half Cycle Park Switch 112, current to the solenoid 207 is interrupted and the slide changing mechanism is stopped at a so-called half cycle. As soon thereafter as the selected slide space is positioned over the projection gate by reason of the drive from the random slide selection device (the aforementioned indexing mechanism within the projector will be disabled since the "Load" button 186 will be held down—rotation to the magazine is imparted by reason of the drive through the magazine teeth 31), the "Load" button is allowed to pop up thereby establishing contact through the terminals 191, 191 and energizing the solenoid 207 (the Full Cycle Park Switch 110 will be closed at this time) for continuing the cycle of operation. The solenoid 207 will be de-energized, for terminating the cycle of operation, when the cam lobe 114 comes into engagement with the Full Cycle Park Switch 110 thereby opening the latter.

WHAT WE CLAIM IS:—

1. A slide projector having an upper

on the cam 91 comes into engagement with the cam follower 90 thereby to shift the cross-arm 85 to the right for commencing lifting movement of the elevating member 80. This member forces the slide-releasing arm 76 upwardly where the upper end 76a thereof will be in a position to contact the end 23b of the spring finger which is disposed over the projection gate. The end 76b of the releasing arm will not come into engagement with the spring retaining finger in the slide magazine until the magazine has been fully indexed and locked in proper position by engagement of the locking teeth 164 with the teeth on gear 122. Shortly after this occurs, the slide-releasing arm 76 will have been elevated to its uppermost position. Then, the cam surface 54c causes further or final leftward movement of the plate 43. This action brings the slide guide projection 42c into engagement with the slide-releasing arm 76 thereby imparting final swinging movement of the latter to the left for shifting or biasing one of the spring fingers 23a to the left thereby to release the slide and allow the same to drop into the expanded gate. At this time, the lifting arm 50 will be near its lowermost position. As the shaft 46 completes its full revolution, the cam 54 will be positioned such that cam following surface 58 on the rocker arm 57 will be allowed to be received in the recess 54b of the cam thereby causing the trailing edge of the opening 57c to contact shutter pin 73 and open the shutter against the force of the spring 71 and also allowing the gate to contract, i.e., the slide guide 42 to shift to the right for gripping the slide. This movement of the slide guide 42 also allows the spring 77 to return the slide-releasing arm to the right, i.e., the position illustrated in Fig. 2. This final movement of the shaft 46 also positions the cam 91 such that the cross-arm 85 is allowed to return to the left under the influence of the spring 94 whereupon the elevating member 80 is lowered allowing the slide-release arm 76 to be lowered completely within the slot 29a as shown in Fig. 2. During this final one-half cycle, the tab 102 on the plate 97 will have shifted to its limit of movement to the right and then will have moved to the left returning to the so-called center position mentioned above. A slide will now be positioned in the gate for projection, and the various parts will be disposed for commencing another cycle of operation as just described.

During a complete slide changing cycle, which is brought about either by operation of the timer or by actuation of the "Cycle Switch" (not shown) which bridges the contacts 212c, 212d, the "Load" button is not depressed and therefore the contacts 191a

and 192a remain in engagement. During a complete slide changing cycle, assuming such cycle is initiated by bridging the contacts 212c, 212d, it will be seen that the solenoid 207 will be energized and a slide changing operation will be commenced as explained above. The contacts 212c, 212d are bridged only momentarily, but when opened the solenoid 207 will continue to be energized because at that time the Full Cycle Park Switch 110 will be closed. The only difference in the cycle of operation from that explained above will be that the indexing mechanism will be brought into operation. As the tab 102 moves to the right and approaches its center position, it will engage the catch 152. Continued movement of the tab 102 to the right during the final 180° movement of the shaft 46 will cause the dog 137 to be brought into engagement with one of the teeth on the indexing gear 122 thereby indexing the magazine to position the next slide-receiving space therein over the projection gate. After this next slide-receiving space is positioned over the gate, the slide-releasing arm 76 then comes into operation for releasing the slide allowing the same to drop into the expanded gate. It will be appreciated that during a cycle of operation initiated either by bridging the contacts 212c, 212d or by operation of the timer, opening and closing of the Half Cycle Park Switch 112 serves no purpose.

When the device for random selection of slides for projection is used, the "Load" Button 186 is mechanically held down until the selected slide space is positioned over the projection gate. Therefore, when the lobe 115 on the cam comes into engagement with the half Cycle Park Switch 112, current to the solenoid 207 is interrupted and the slide changing mechanism is stopped at a so-called half cycle. As soon thereafter as the selected slide space is positioned over the projection gate by reason of the drive from the random slide selection device (the aforementioned indexing mechanism within the projector will be disabled since the "Load" button 186 will be held down—rotation to the magazine is imparted by reason of the drive through the magazine teeth 31), the "Load" button is allowed to pop up thereby establishing contact through the terminals 191, 191 and energizing the solenoid 207 (the Full Cycle Park Switch 110 will be closed at this time) for continuing the cycle of operation. The solenoid 207 will be de-energized, for terminating the cycle of operation, when the cam lobe 114 comes into engagement with the Full Cycle Park Switch 110 thereby opening the latter.

WHAT WE CLAIM IS:—

1. A slide projector having an upper



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5 wall on which a slide magazine can be
reversely over the upper wall to present slides
contained in the magazine singly and
sequentially over an aperture in the upper
wall registering and communicating with a
projector gate in the projector to allow the
slides to pass between the magazine and the
projector gate, means within the projector
to lower the slides from the magazine into
the projector gate for projection and to
return the slides to the magazine after pro-
jection, and indexing means for engagement
with indexing projections on the slide maga-
zine to move the magazine forwardly and
reversely over the aperture in timed se-
quence with the projection of the slides, the
indexing means including an indexing gear
for engagement with the projections when
the magazine is operatively mounted on the
projector, an indexing member having for-
ward and reverse teeth alternatively en-
gageable with the gear in response to shift-
ing of the member between forward and
reverse positions, shifting means connected
with the indexing member for moving the
indexing member back and forth between
said positions, actuating means connected
with the indexing member for moving the
same through an indexing cycle, and index-
ing locking means comprising, a locking
member having at least one tooth arranged
to engage the indexing gear for locking the
gear, the locking member being mounted
for movement between a locked and an un-
locked position, and spring means connected
to the locking member and to the actu-
ating means for yieldably moving the locking
member to its locked position, the actu-
ating means including an element engageable
with the locking member for positively
returning the locking member to its un-
locked position.

2. A slide projector as claimed in claim
1 including a random selection attachment
having a gear wheel arranged to engage with
a second set of indexing projections pro-
vided on the slide magazine and to move
said magazine forwardly or reversely to
enable random selection and projection of
the slides contained therein when the in-
dexing means is deactivated.

3. A slide projector as claimed in claim
1 or 2 in which the indexing locking means
comprises an upper gear wheel having teeth
mounted above the top wall of the pro-
jector and arranged to engage in the index-
ing projections provided on the slide maga-
zine, a lower gear wheel mounted below
the top wall of the projector coaxial with
said upper gear wheel and rotatable there-
with, a hub portion connecting the gear
wheels passing through an opening in the
upper wall of the projector, a bracket plate
mounted parallel to and in spaced relation

below the upper wall of the projector, an
aperture in the bracket plate receiving a
pin connecting the upper and lower gear
wheels together, a rectangular opening in
the centre of the bracket plate, a circular
opening near the opposite end thereof to
the gears, a second hub member attached
at one end to the bracket plate at the cir-
cular opening and at its other end to the
lower side of the top wall of the pro-
jector and a notch cut in the end of the
bracket plate opposite the gears, a second
or indexing plate mounted above the bracket
plate and longitudinally slidable with re-
spect thereto, means on the second plate to
prevent lateral movement with respect to
the bracket plate, a substantially rectangular
aperture in the second plate overlying the
rectangular aperture in the bracket plate,
the aperture having its end side remote from
the gears of an inwardly convexly arcuate
form, longitudinally elongated opening at
the end opposite the gears accommodating
the second hub member, a narrow trans-
verse slot in the outer end of the second
plate overlying the notch in the end of
the bracket plate and indexing dogs on the
end of the second plate adjacent the gears
and arranged for alternative engagement
with the teeth of the lower gear wheel to
rotate the latter in either direction and a
tab member stepped downwardly from one
edge of the plate and having a slot at right
angles to the plate to accommodate one
end of a stiff wire attached at its other
end to an overcentre linkage, a third or
actuating plate mounted above the indexing
plate having an elongated slot slidably and
rotatingly accommodating the second hub
in its end remote from the gears, a pin
mounted in the end of the actuating plate
passing downwardly through the transverse
slot in the indexing plate, an extended por-
tion of the actuating plate defining a catch
member and having an integral upstand-
ing tab, the catch member overlying the
longitudinal slots in the bracket and index-
ing plates, the actuating plate being also
provided with a laterally extending integral
tab having a recess for receiving an end
of a spring, and a fourth or locking plate
mounted above and vertically spaced from
the actuating plate and having an elon-
gated aperture in its end remote from the
gears and embracing the hub passing
through the slots in the indexing and actu-
ating plates, a downwardly extending tab
on the same end of the locking plate hav-
ing a recess to receive the other end of
the spring attached to the actuating plate,
the locking plate having a longitudinal slot
overlying the longitudinal slots in the other
plates, the locking plate terminating at its
end adjacent the indexing gears in an
open longitudinal slot terminating in a pair



of locking teeth adapted for locking engagement with the teeth on the lower gear wheel, the locking plate also having means for holding the locking and indexing plates in parallel spaced relation and a plate located within the projector housing adapted to be moved to and fro in a vertical plane parallel to the longitudinal axis of said plates in timed relationship with the other mechanisms in the projector and having an upstanding tab passing in the plates of the indexing means and to operate the same by coaction with the catch member and slots.

4. A slide projector as claimed in claim 1, 2 or 3 having a cyclically operated slide changing mechanism comprising a shaft which is rotated through 360° during each cycle of operation, a clutch connecting the shaft to an operating motor, a solenoid for activating said clutch, a first normally open switch and a second normally closed switch, each of the switches having one terminal thereof connected to a common terminal of the solenoid, a switch operating member mounted on the shaft for rotation therewith whereby the first switch is caused to close upon commencement of rotation of the shaft and the second switch is caused to open as the shaft is rotated through approximately one half of a revolution, and a selector switch connected to the other terminals of the first and second switches for alternatively connecting the latter in a power circuit which is connected to the other terminal of the solenoid.

5. A slide projector as claimed in claim 4 in which both the first and second switches are spring biased to the closed positions.

6. A slide projector as claimed in claim 5 in which the switch operating member is arranged to hold the first switch open only when the shaft is in the rest shaft position and to open the second switch momentarily as the shaft completes approximately one-half of its revolution.

7. A slide projector as claimed in claim 4, 5 or 6 in which the selector switch includes first and second fixed contacts and a movable contact for alternative engagement with the fixed contacts, the first and second fixed contacts being connected to the other contacts of the first and second switches respectively.

8. A slide projector as claimed in claim 7 in which the movable contact is connected

in a power circuit connected to the other terminal of the solenoid.

9. A slide projector as claimed in claim 7 or 8 in which the movable contact is normally in engagement with the first contact.

10. A slide projector as claimed in any preceding claim having disabling means connected with the indexing means and movable to a first position for de-activating the indexing means and to a second position for reactivating the indexing means, a formation on the magazine, a latch on the projector movable to a first position for overlying the formation, thereby preventing separation of the magazine from the projector, and to a second position for clearing the formation to permit separation of the magazine from the projector, and a control member mounted on the projector for movement back and forth between a first position and a second position, the control member being connected with the disabling means and the latch such that movement of the control member to its first position causes substantially simultaneous movement of the disabling means and the latch to the first positions thereof and movement of the control member to its second position causes substantially simultaneous movement of the disabling means and the latch to the second positions thereof.

11. A slide projector as claimed in claim 10 when dependent on any one of claims 4 to 9 including operating means connected to the selector switch and to the indexing disabling means to activate the latter when the selector switch connects the second switch in the power circuit.

12. A slide projector as claimed in claim 10 when dependent on any one of claims 4 to 9 including operating means connected to the movable contact of the selector switch and to the disabling means for activating the latter to disable the indexing means when the movable contact is in engagement with the second contact.

13. A slide projector substantially as herein described with reference to the accompanying drawings.

POLLAK, MERCER & TENCH,
Chartered Patent Agents,
Audrey House, Ely Place,
London, EC1N 6SN,
Agents for the Applicants.