United States Patent [19]

Erchoff

[11] **3,827,796**

[45] **Aug. 6, 1974**

[54] **SLIDE TRAY INDEXING MECHANISM FOR SLIDE PROJECTORS AND THE LIKE**

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[22] Filed: **Jan. 29, 1973**

[21] Appl. No.: **327,801**

[52] **U.S. Cl.** **353/116**
[51] **Int. Cl.** **G03b 23/04**
[58] **Field of Search** 353/103-117; 40/79

[56] **References Cited**

UNITED STATES PATENTS

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FOREIGN PATENTS OR APPLICATIONS

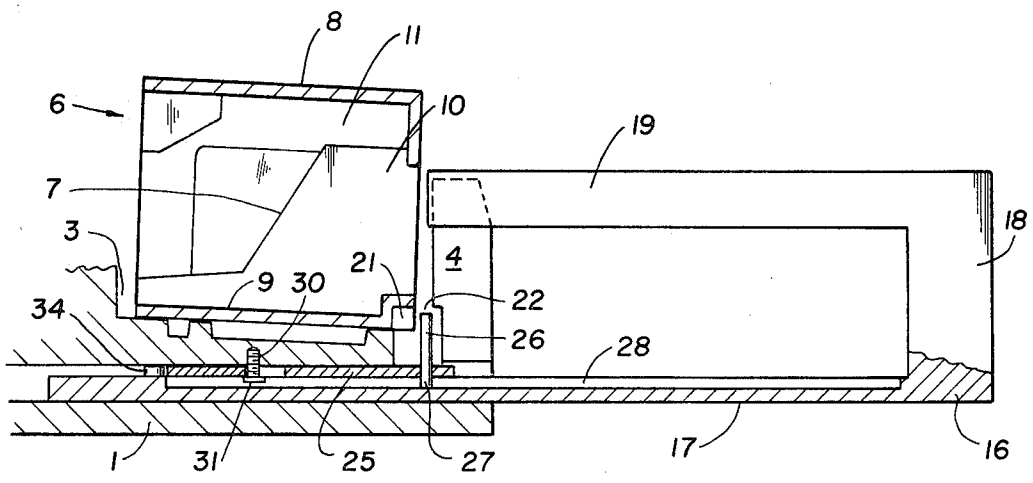
1,065,668	4/1967	Great Britain	353/116

Primary Examiner—Louis R. Prince
Assistant Examiner—A. Jason Mirabito
Attorney, Agent, or Firm—Walter C. Kehm; Samson B. Leavitt

[57] **ABSTRACT**

A reversible slide tray indexing mechanism is provided which comprises an indexing lever slidably and pivotably mounted on the base of a slide projector having a pawl for sequential engagement with a rack of indexing projections formed on the periphery of a slide tray, and an actuating member for imparting the required movement thereto. The slide carrier of the projector is provided with a camway in operative engagement with said actuating member for transversely moving said pawl out of engagement with the rack of indexing projections and permitting pviotal movement thereof into alignment with the next projection of the indexing rack upon withdrawl of the slide carrier from the projector, and transversely moving said pawl into engagement with said next projection and pivotally moving said lever to advance the slide tray to the next position by transporting the same through an extent corresponding to the distance between two adjacent projections on the rack upon insertion of the slide carrier into the projector. Forward and reverse operation is controlled by means of a slidable bracket in engagement with the indexing lever to selectively bias the same for pivotal movement in the desired direction.

21 Claims, 17 Drawing Figures



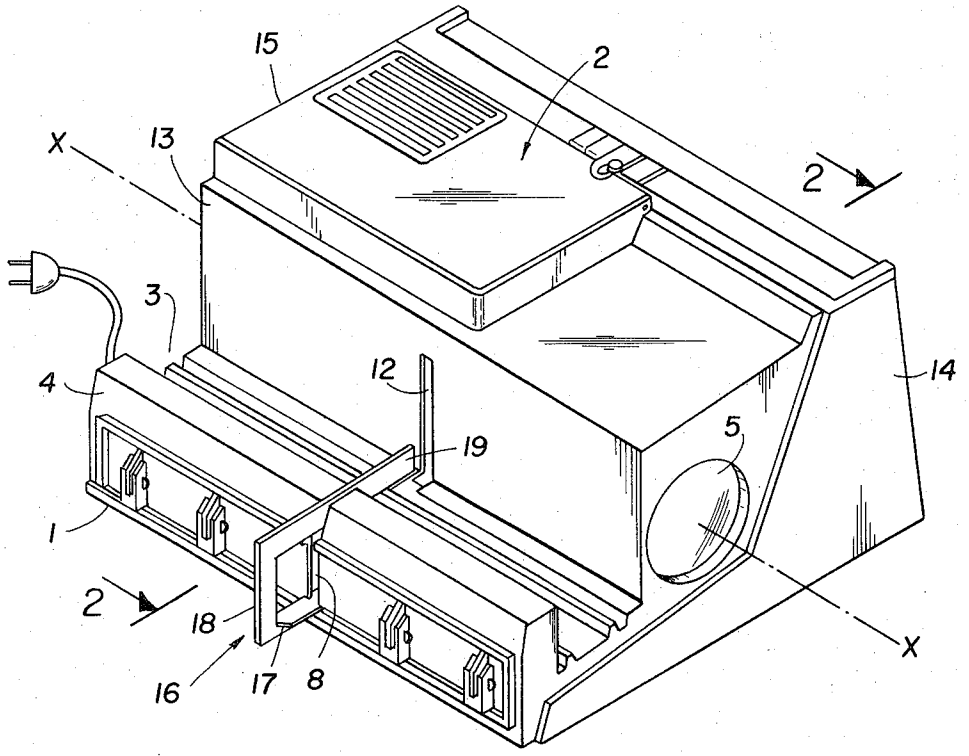

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FIG. 1

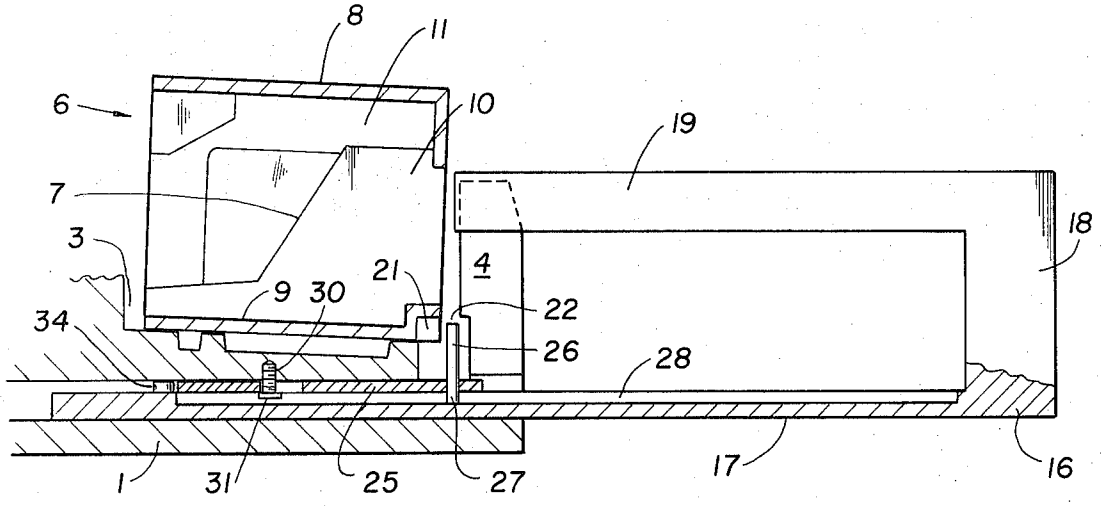
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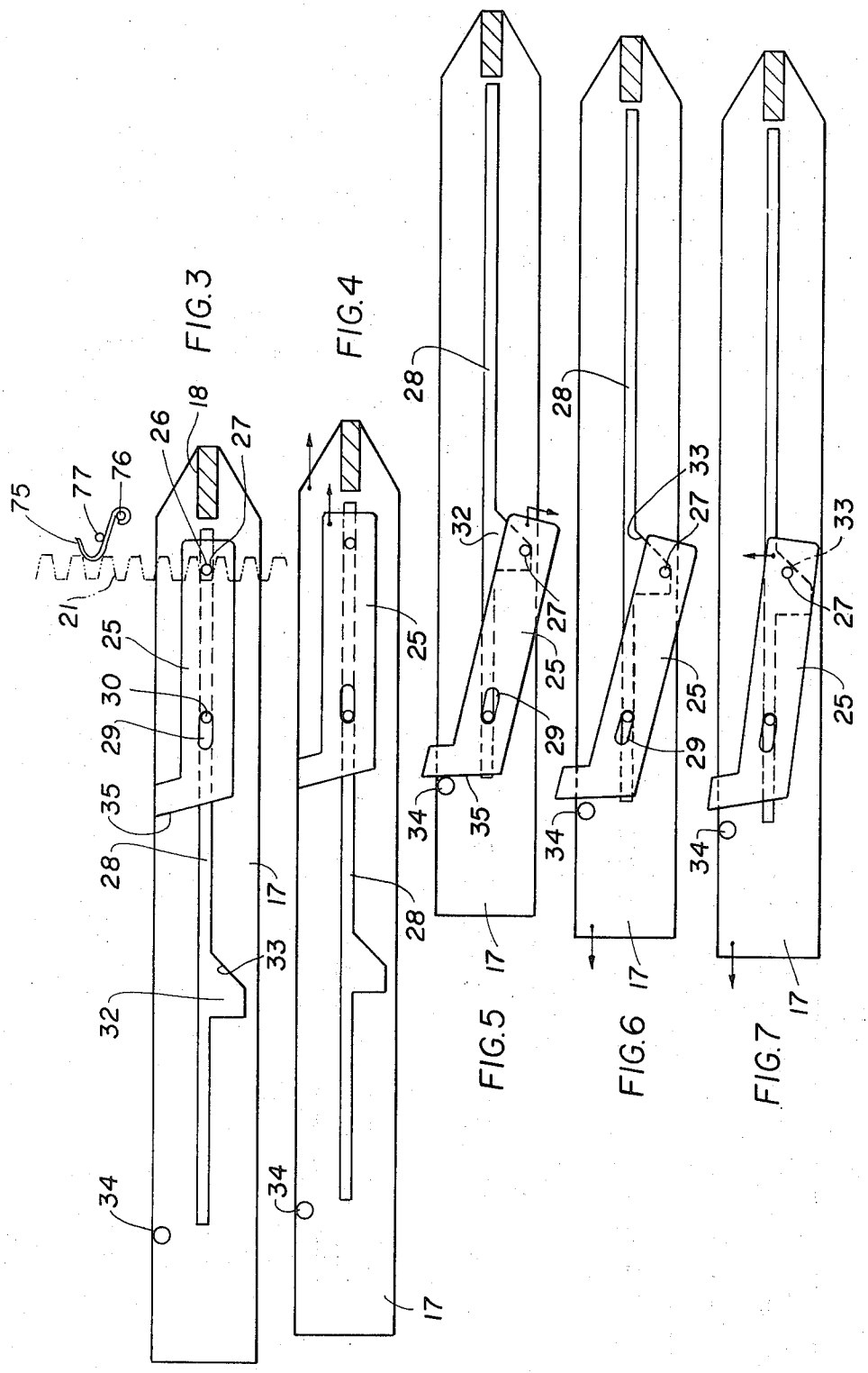
FIG. 2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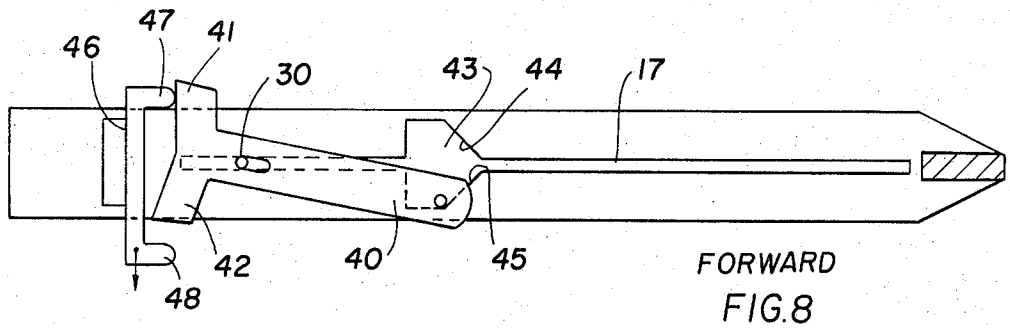


FIG.8

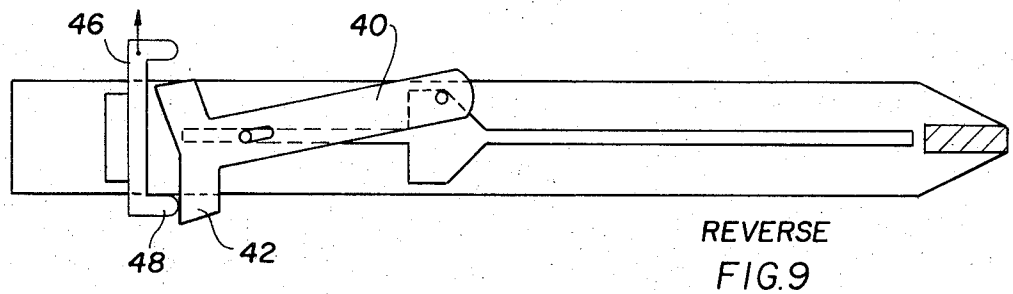


FIG.9

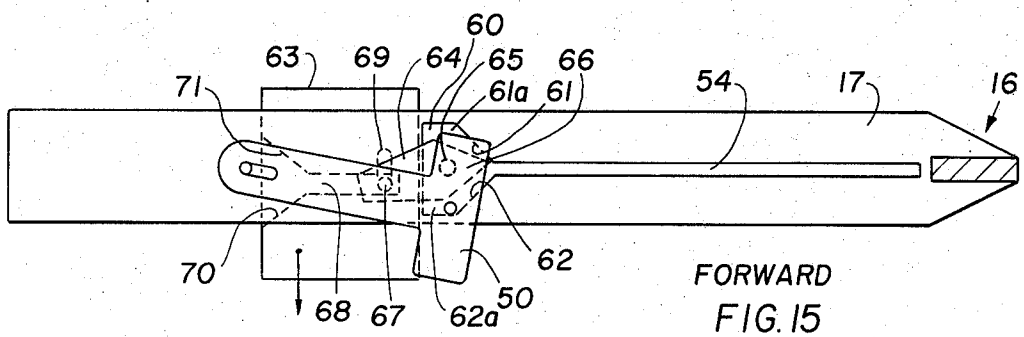


FIG.15

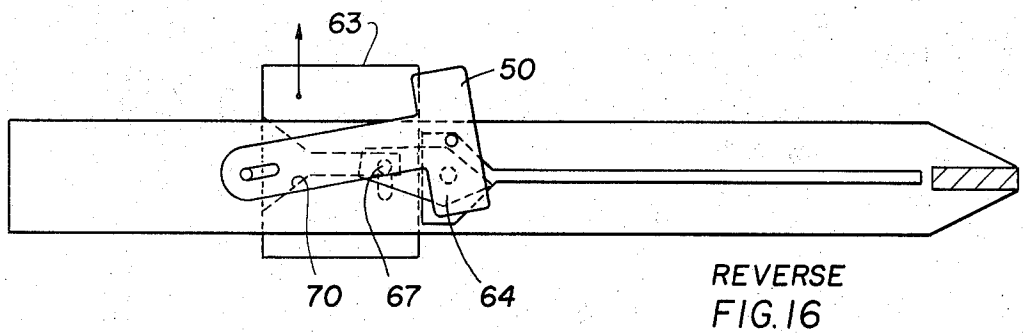


FIG.16

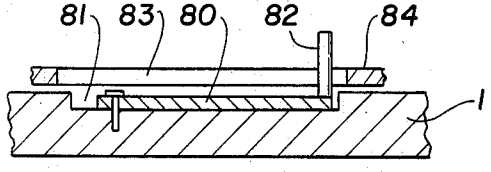
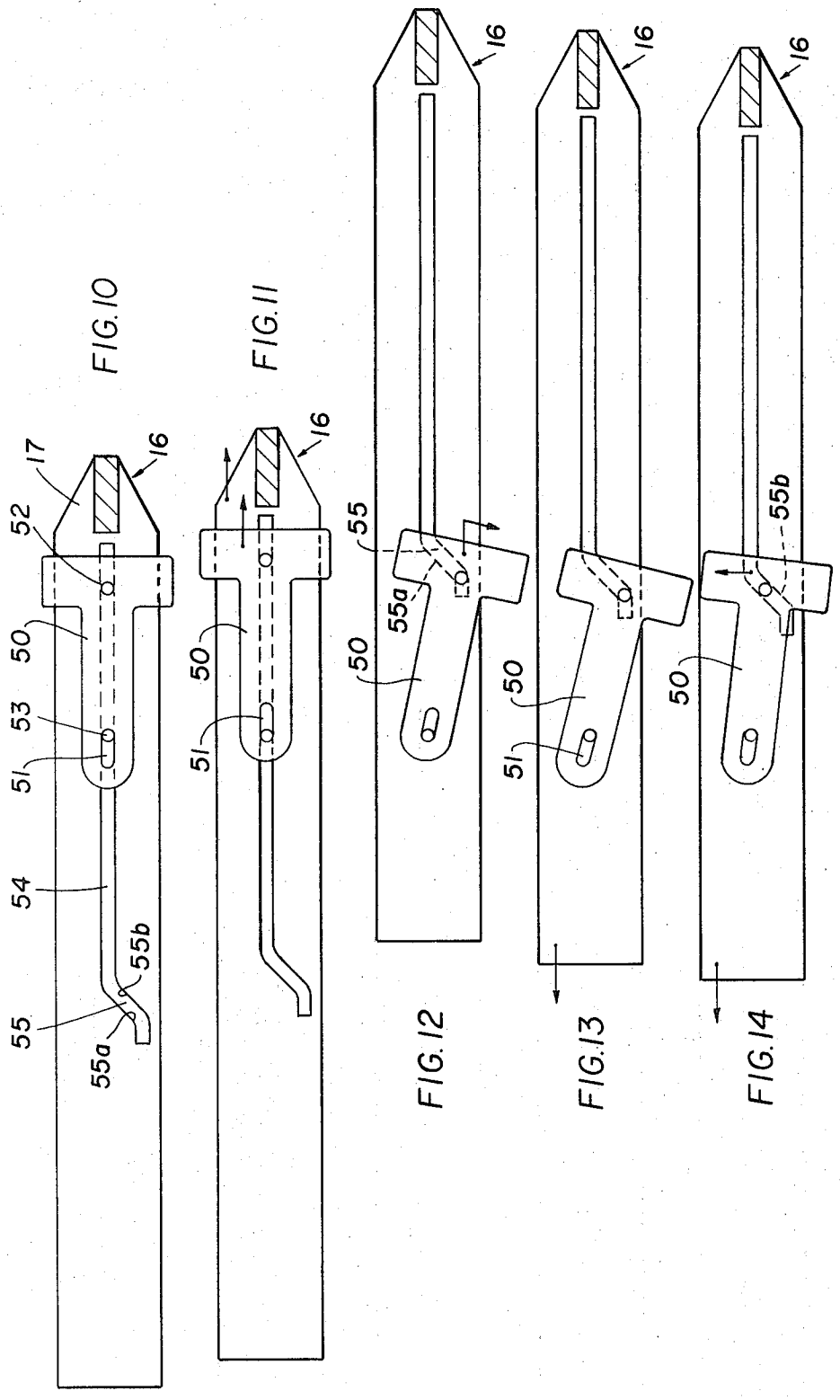


FIG.17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SLIDE TRAY INDEXING MECHANISM FOR SLIDE PROJECTORS AND THE LIKE

BACKGROUND OF THE INVENTION

It is well known to provide slide projectors of the type adapted to receive a slide tray containing a plurality of uniformly spaced apart slides, and having a slide carrier which is reciprocal in a direction transversely of the optical axis of the projector for advancing slides from the tray to the viewing position and then returning such slides to the slide tray.

Such projectors are usually provided with means for indexing the slide tray from one slide position to the next, so that all of the slides in the tray may be sequentially advanced into the viewing position. Many projectors utilize slide trays which are provided with a peripheral rack of teeth or other projections, each one of which corresponds to a slide receiving space in the tray. An indexing gear in the projector is adapted to operatively engage the teeth or projections to sequentially advance the tray from slide to slide. The indexing means associated with such projectors are often in the form of a pawl type device which is slidably and pivotally mounted on the base of the projector and urged into engagement with the indexing gear by means of the slide carrier. In many cases a pair of alternate pawl plates are provided to accomplish forward and reverse movement of the indexing gear. One pawl is adapted to engage one side of the indexing gear for rotation in one direction, while the other pawl is alternatively adapted to engage the other side of the indexing gear for rotation in the opposite direction. The pawls are pivotally mounted on the end of each plate and are provided with springs which snap the pawl of engagement with the gear at the completion of the slide changing stroke. A ball type detent is usually employed to engage the indexing gear to maintain it in the proper position to hold the slide tray at the end of each slide transfer stroke. An indexing mechanism of this type is shown in U.S. Pat. No. 3,120,150 to Brown. Similar indexing means have been provided in which the pivotally mounted pawl is adapted to directly engage the indexing teeth of the slide tray. An example of this type of indexing device is disclosed in U.S. Pat. No. 3,319,370 to Robinson.

Unfortunately, these types of devices are rather complex and relatively expensive to construct. In addition, they have the disadvantage of being quite noisy and unpleasant due to the snapping of the pawls and, in those instances where indexing gears are provided, the locking of the ball type detent between the teeth of the indexing gear during successive rotations of the gear.

Other indexing means, which have been utilized, comprise a single reciprocable lever having a pawl at one end adapted to directly engage the teeth of a slide tray. The lever is adapted to be pivoted upon engagement of the pawl and the slide tray teeth to effectuate the advancement thereof. U.S. Pat. No. 3,049,052 to Korf provides an example of this type of indexing mechanism. Although the construction shown in the Korf patent appears to be simpler than the pawl type systems described above, it also has several drawbacks. The lever arm in Korf is pivotally mounted on and keyed via a slotted opening to a spring biased operating bracket which is mounted on the base of the slide projector. The bracket is linked to the slide changing mechanism which in turn imparts reciprocal and pivotal movement via the bracket to the lever. In order for the pawl to disengage the teeth on the slide tray, it is adapted to be vertically lowered out of such engagement upon withdrawal of the slide changer. This is a complex arrangement which, from a cost and reliability standpoint, presents no improvement over the previously described pawl type indexing mechanisms. Furthermore, the Korf device does not in any way provide for reverse operation for the slide tray. This, of course, is quite inconvenient to the operator and a severe disadvantage of the device.

SUMMARY OF THE INVENTION

In accordance with the present invention, a slide projector indexing mechanism is provided which overcomes the insufficiencies found in the prior devices. The indexing mechanism of the present invention utilizes a pivotally and reciprocally movable lever arm having a pawl at one end thereof for engagement with the indexing projections of a slide tray, but is arranged such that it is in direct engagement with the slide carrier of the projector without the need for an intermediate actuating bracket, and requires movement only in a horizontal plane to effectuate slide tray advancement. In addition, the present invention provides means to permit forward and reverse indexing operations with the use of but a single indexing lever and pawl. Furthermore, the slide tray indexing mechanism of the invention is extremely quiet in operation, relatively simple in construction and rather inexpensive to produce.

In general, the slide tray indexing mechanism of the invention is adapted for use in slide projectors of the type having a slide tray receiving groove for a slide tray having a plurality of slide receiving spaces, and a slide carrier slidably disposed for reciprocating movement transversely to the slide tray receiving groove for transfering a slide from a slide tray installed therein to the viewing position on the optical axis of the projector and returning the same to the slide tray. The device comprises, in combination, an indexing lever slidably mounted on the base of the slide projector for reciprocal movement transversely to the direction of movement of the slide tray and pivotal movement parallel to the direction of movement of the slide tray, and having pawl at one end for sequential engagement with a rack of indexing projections formed on the periphery of the slide tray, and an actuating member for imparting the required movement thereto; and a camway formed in the slide carrier of the projector in operative engagement with said actuating member for transversely moving said pawl out of engagement with the rack of indexing projections and permitting pivotal movement thereof into alignment with the next projection of the indexing rack upon withdrawal of the slide carrier from the projector, and for transversely moving said pawl into engagement with said next projection and pivotally moving the lever to advance the slide tray to the next slide position by transporting the same through an extent corresponding to the distance between two adjacent projections on the rack upon insertion of the slide carrier into the projector.

As an additional feature, the indexing lever can be adapted for pivotal movement to effectuate either forward or reverse advancement of the slide tray. To accomplish such operation, a slidable forward-reverse control means is provided in engagement with the in-

dexing lever to selectively bias the same for a pivotal movement in the desired direction.

The indexing lever is formed with a longitudinal slot and is mounted to the base of the projector beneath the slide tray receiving groove in longitudinal alignment with the slide carrier by means of a pin which slidably engages such slot. This type of arrangement permits pivotal movement of the lever and limited reciprocal travel thereof transversely to the direction of movement of the slide tray. The pawl is preferably mounted on the indexing lever in longitudinal alignment with the mounting slot and extends through a suitable opening formed in the base of the slide tray receiving groove in a position to engage the indexing rack of the slide tray. It should be noted that the lever can be mounted either above or below the slide carrier. When the lever is mounted above the slide carrier, the actuating member of the lever can be a downwardly extending portion of the pawl or, alternately, a pin or tab mounted on the lever. When the lever is mounted below the slide carrier, the lower portion of the pawl itself can serve as the actuating member. In either case, it is preferable that the actuating member also be in longitudinal alignment with the pawl and the mounting slot to simplify the pivotal and reciprocal travel requirements of the lever.

The camway formed in the slide carrier is preferably in the form of an elongated slot or groove corresponding in width to the width or diameter of the actuating member to slidably receive the same, and extends longitudinally along the base portion of the slide carrier beneath the slide tray receiving groove of the projector. A section of the camway is disposed at an angle with respect to the elongated slot, so that the engagement of the angular section with the actuating member of the indexing lever effectuates pivotal movement of such lever. The angular section of the camway can be formed as a part of the slot having the same width thereof, so that the relative movement between the slide carrier and the actuating member of the lever effectuates the desired pivotal movement during both the withdrawal and insertion strokes of the slide carrier. As an alternative embodiment, the angular portion of the camway can be an enlarged section of the slot having one or more angular walls which effectuates pivotal movement of the lever only during the insertion stroke of the slide carrier. In this embodiment, pivotal movement of the lever during the withdrawal stroke is accomplished by the provision of an upstanding lug formed on the slide carrier and adapted to engage the innermost end of the lever upon withdrawal of the slide carrier. The upstanding lug is positioned off center with respect to the camway so that its engagement with the end of the lever creates a moment to pivotally move the same about the mounting pin.

The slide carrier and the indexing lever cooperate with one another in a manner such that the slide tray can be advanced only after the previously viewed slide has been fully returned to its appropriate slide receiving space within the slide tray. This is accomplished by suitably positioning and tolerancing the angular section of the camway in the base portion of the slide carrier with respect to the slide pusher arm thereof which transports the slides to the viewing position.

To prevent unintentional movement of the slide tray when the slide carrier is fully withdrawn and the pawl on the indexing lever has disengaged the indexing teeth on the slide tray, a detent means in the form of a spring clip or a spring biased ball can be provided to engage the teeth of the indexing rack of the tray to maintain it in the selected position. The detent means, however, does not interfere with the movement of the tray when force is applied to it manually by the operator or by means of the indexing lever during normal reciprocating movement of the slide carrier.

In a preferred embodiment the indexing means is adapted for both forward and reverse operation. To implement such operation the camway is provided with two symmetrical angular sections and a slidable forward-reverse control means, as mentioned hereinabove, is included to selectively bias the indexing lever for pivotal movement in a manner such that the actuating member engages one or the other of such symmetrical angular sections. The forward-reverse control means is preferably in the form of a bracket which extends transversely of the slide carrier and is adapted to directly engage either the actuating member or the lever itself upon withdrawal of the slide carrier. The bracket is slidable between a forward position in which the actuating member of the indexing lever is biased into engagement with one angular section of the camway for forward operation, and a reverse position in which the actuating member is biased into engagement with the opposite angular section of the camway for reverse operation. The bracket can be controlled by an operating lever or knob connected thereto and disposed on the exterior of the projector for manual selection of the forward or reverse modes, or by an electromagnetic solenoid device operated by a selector switch.

The foregoing and other features of the indexing means of the invention are more fully described with reference to the annexed drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a slide projector embodying the invention.

FIG. **2** is a partial cross-sectional view transverse to the optical axis of the projector taken along the lines **2—2** of FIG. **1**.

FIG. **3** is a top plan view of one embodiment of the slide indexing mechanism of the invention.

FIGS. **4** through **7** are top plan views of the embodiment of the slide indexing mechanism of the invention shown in FIG. **3** illustrating various positions of the indexing lever.

FIG. **8** is a top plan view of another embodiment of the slide indexing mechanism of the invention adapted for both forward and reverse operation and shown in the forward operating mode.

FIG. **9** is a top plan view of the embodiment of the invention shown in FIG. **8** illustrating the reverse operating mode.

FIG. **10** is a top plan view of still another embodiment of the slide indexing mechanism.

FIG. **11** through **14** are top plan views of the embodiment of the invention shown in FIG. **10** illustrating various positions of the indexing lever thereof.

FIG. **15** is a top plan view of another embodiment of the slide indexing mechanism of the invention adapted for both forward and reverse operation, showing the forward mode of operation.

FIG. **16** is a top plan view of the embodiment of the invention shown in FIG. **15** illustrating the indexing lever in a position for reverse operation.

FIG. 17 is a partial cross-sectional view showing the indexing lever mounted below the slide carrier.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 1, a slide projector which embodies the indexing mechanism of the present invention is shown which includes a base plate 1 and a projector housing 2 fitted thereof. The housing 2 is provided with a slide tray receiving channel or troughlike groove 3 defined by walls 4 and 13 and which extends along one side thereof and is open at its top and front and rear ends for receiving a known type slide tray 6 in which a plurality of slides 7 may be stored.

As shown in FIG. 2 the slide tray 6 is formed of an upper wall 8 and a lower wall 9 connected together by transverse partitions 10 uniformly spaced form each other by a distance approximately equal to the thickness of the frame 11 of slides 7. Although a box-like slide tray is shown, it will be apparent to those skilled in the art that projectors of this type are also adapted to receive circular vertically disposed slide trays, such as that shown in U.S. Pat. No. Re 26,619 to Hall.

The optical axis of the projector is indicated by a broken line X—X in FIG. 1, and is as well known in the art, a lamp, condenser lenses (not shown) and focusing lenses 5 are disposed in the projector housing 2 in alignment with the optical axis X—X thereof. A vertically extending slide receiving aperture 12 is formed in vertical wall 13 which defines the inner wall of slide receiving groove 3, approximately midway between the front wall 14 and the rear wall 15 of the projector housing 2, to permit the transfer of slides from the slide tray disposed in the groove 3 to a viewing position in the projector and the return of a slide from the viewing position to the slide tray.

A slide carrier 16 is mounted for reciprocal sliding movement transversely of the optical axis X—X and is adapted for transferring slides between the slide tray 6 and the viewing aperture 12 in the projector. The slide carrier 16 is characterized by an elongated base member 17 supported for sliding movement within the base plate 1 of the projector, a handle 18 which extends upwardly from the outer end of the base member 17, a pusher arm 19 which extends inwardly from the upper end of the handle member towards the optical axis X—X of the projector in parallel spaced arrangement above the base member 17, and by a vertically disposed plate member (now shown) which is secured by suitable fastening means to the opposite end of base member 17 for returning slides to the slide tray. Details of the slide carrier of the type embodied in the projector disclosed herein are more fully described in U.S. Pat. No. 3,183,774 to Kurz.

When the slide carrier 16 is inserted inwardly from its outermost position, the innermost end of the pusher arm 19 engages a slide stored in the slide tray 6 so as to transfer the slide from the slide tray through the vertical slide aperture 12 to a viewing position in the projector on the optical axis. The slide is returned to the slide tray 6 from its viewing position in the projector upon the outward withdrawal of the slide carrier 16 from its innermost position. After the slide carrier has returned the previously viewed slide to the slide tray 6, the slide tray is automatically advanced by the indexing means of the invention to present the next slide in the tray for viewing.

The slide trays employed are provided with a peripheral rack of teeth 21, or other suitable projections, each of which corresponds to a slide receiving space in the tray. At the base of the tray receiving groove 3 in the projector an opening 22 is provided adjacent teeth 21 to permit operative engagement of such teeth by the indexing mechanism of the invention during each reciprocating stroke of the slide carrier 16.

The embodiment of the indexing mechanism shown in FIGS. 2–7 comprises an indexing lever 25 slidably mounted beneath the slide tray receiving groove 3 in sliding engagement with the base member 17 of the slide carrier for reciprocal movement transversely to the direction of movement of the slide tray 6, and pivotal movement parallel to the direction of movement of the slide tray. The lever 25 has an upstanding pawl 26 rigidly mounted at one end for sequential engagement with teeth 21 of slide tray 6 and a downwardly extended actuating member 27 formed as a part of pawl 26, to implement the pivotal movement thereof. An axial slot 29 is formed in the rear portion of the indexing lever 25. A mounting pin 30 slidably extends through slot 29 and threadably engages the projector base 1 to secure the lever in place and permit pivoted movement and reciprocating movement thereof over the length of slot 29. Pin 30 has an enlarged head portion 31 which serves as a retaining disc to hold lever 25 in contact with base 1 of the projector beneath slide tray receiving groove 3. Alternatively, the enlarged head 31 can be eliminated since the base member 17 of the slide carrier also holds the lever 25 in place.

The base member 17 of the slide carrier 16 has an integral camway 28 formed therein in operative engagement with the actuating member 27 of the indexing lever 25 for imparting the required pivotal and reciprocal movement thereto during the insertion and withdrawal strokes of the slide carrier. As shown in FIGS. 3 to 7, the camway 28 is in the form of an elongated slot corresponding in width to the diameter of actuating member 27 to slidably receive the same and thereby control the extent of pivotal movement of indexing lever 25. The camway 28 extends longitudinally along the base member of the slide carrier over a substantial length thereof and has an enlarged section 32 having a wall 33 disposed at an angle with respect to the elongated section of camway 28. The enlarged section 32 permits pivotal movement of indexing lever 25 over an arcuate extent corresponding to the distance between adjacent indexing teeth in rack 21 by receiving therein actuating member 27 upon withdrawal of the slide carrier 16 from the projector. During the insertion stroke, angular wall 33 engages actuating member 27 to pivotally move lever 25 in the opposite direction through the same arcuate to advance slide tray 6 to the next slide position. It should be noted that mounting pin 30 also engages camway 28, which extends inwardly beyond enlarged section 32, to insure proper alignment between the indexing lever and the slide carrier.

An upstanding lug 34 is fixedly mounted on the base member 17 of slide carrier 16 in a position off center with respect to camway 28. Lug 34 is adapted to engage an obliquely disposed tab portion 35 on the end of indexing lever 25 to pivotally bias the lever when actuating member 27 reaches the enlarged section 32 of the camway during the withdrawal stroke of the slide carrier to position pawl 26 for engagement with the following tooth in rack 21. It should be noted that the po-

sition of enlarged section 32 of the camway 28 and lug 34 with respect to the end of pusher arm 19 of the slide carrier is such that pivotal movement of the indexing lever 25 is effectuated only after the previously viewed slide has been fully returned to the appropriate slide receiving space within slide tray 6 during withdrawal of the slide carrier. Similarly, the position of angular wall 33 of section 32 is such that lever 25 completes its pivotal movement to advance the slide tray to the next slide position prior to the engagement of the pusher arm 19 and a slide 7 contained within the slide tray 6 during insertion of the slide carrier.

The operation of this device is remarkably simple and is illustrated in FIGS. 3 to 7. FIG. 3 shows the slide carrier 16 fully inserted in the slide projector and the indexing lever 25 positioned with pawl 26 in engagement with the teeth 21 of the slide tray 6. Upon initial withdrawal of the slide carrier, lever 25 is carried therewith the distance of axial slot 29 formed therein. Such movement is accomplished by the frictional force between the bottom surface of the lever 25 and the top surface of base member 17, which is sufficient to overcome the holding force of pin 30 within slot 29, so that the indexing lever 25 will move in the manner described above. In addition, by dimensioning the actuating member 27 for a close fit with the camway 28 an additional frictional force therebetween is obtained. Alternatively, a small spring (not shown) can be provided to bias the lever 25 inwardly for engagement of the pawl and the slide tray teeth. In such instance the engagement of the lug 34 and the lever near the end of the slide carrier withdrawal stroke will advance the lever the distance of slot 29. In this position, which is shown in FIG. 4, the indexing pawl 26 is out of engagement with the rack 21 of indexing teeth formed on the slide tray. In the fully withdrawn position of the slide carrier, as shown in FIG. 5, the actuating member 27 is in alignment with enlarged section 32 of the camway and upstanding lug 34 engages tap portion 35 of the indexing lever 25 to pivotally move the lever into the position shown. As the slide carrier 16 is again inserted into the slide projector, lever 25 is inwardly advanced the distance of slot 29, to enable pawl 26 to engage the next tooth in the slide tray indexing rack 21. Further inward movement of the slide carrier, as shown in FIG. 6 and 7, places the angular wall 33 of the enlarged camway section 32 of the camway in engagement with the actuating member 27 to pivotally move lever 25 to the starting position shown in FIG. 3, thus causing pawl 26 to advance the slide tray to the next slide space.

To secure the slide tray 6 in place when the slide carrier is withdrawn, a spring clip 75 is provided to engage the teeth 21 of the slide tray. As shown in FIG. 3, the spring clip 75 is mounted on the base 1 of the projector by means of pin 76 and is urged into engagement with the teeth by pin 77. The engagement of the spring clip 75 and the tray is adapted to prevent unintentional movement of the tray, but does not interfere with the operation of the indexing mechanism, nor with the insertion or removal of the slide tray from the projector.

The embodiment of the invention shown in FIGS. 8 and 9 utilizes the same basic construction as in the previously described embodiment, but is adapted for both forward and reverse advancement of the slide tray. To accomplish such operation, indexing lever 40, which corresponds to lever 25 in the first described embodiment, is formed with a pair of symmetrically disposed tab portions 41 and 42. In addition, an enlarged section 43 of the camway formed in the base member 17 of the slide carrier is defined in part by a pair of angular symmetrical walls 44 and 45, in which wall 45 is equivalent to wall 33 described above and wall 44 is the mirror image thereof. A forward-reverse control bracket 46 is slidably disposed above base member 17 of the slide carrier 16 for reciprocating movement in a plane substantially perpendicular thereto. The bracket 46 is formed with a pair of control lugs 47 and 48 disposed at opposite ends thereof, and adapted to selectively engage indexing lever 40 to pivotally move the same about mounting pin 30 into a position for either forward or reverse operation. The position of bracket 46 determines whether lug 47 or lug 48 will engage tab sections 41 or 42, and thereby determines whether the tray will be advanced in a forward or reverse direction. As shown in FIG. 8 the control bracket 46 is in a position for forward operation whereby pivotal movement is substantially the same as that described above with relation to the embodiment shown in FIGS. 3 to 7. In FIG. 9 the control bracket is in a position for reverse operation whereby lug 48 engages tab section 42 of indexing lever 40, thereby causing pivotal movement in the opposite direction. The operation of the indexing mechanism in the reverse mode is substantially the same as the operation described with relation to the forward mode and need not be described in detail herein.

The forward-reverse control bracket 46 can be connected by suitable linking means to an electromagnetic solenoid to selectively move the same into the desired position. A forward-reverse selector switch in the electrical circuit to the solenoid can be mounted on the projector housing or remote hand piece to permit manual actuation of the solenoid. Alternatively, bracket 46 can be mechanically connected to an external selector knob or lever mounted on the housing for manual selection of the desired mode of operation.

Another preferred embodiment of the invention is shown in FIGS. 10 through 14. This embodiment differs from the embodiment described above by the elimination of the upstanding lug to pivotally move the indexing lever during the withdrawal stroke of the slide carrier and the provision of a slotted camway to accomplish such movement. Referring to FIG. 10, it can be seen that this embodiment of the invention comprises an indexing lever 50 having an axial mounting slot 51 formed therein at one end and an upstanding pawl 52 formed in the opposite end for incrementally and sequentially engaging the indexing teeth of a slide tray disposed within the slide receiving groove of the projector. Indexing lever 50 is mounted on the base of the projector beneath the slide tray receiving groove by means of retaining pin 53, which slidably engages slot 51 to permit pivotal movement of the lever and limited reciprocal movement thereof. The base member 17 of slide carrier 16 has a camway 54 in the form of a substantially elongated slot extending longitudinally therealong. A section 55 of the camway 54 is disposed at an angle with respect to the remaining portion. A downwardly extending section of pawl 52 engages the camway 54 formed in the slide carrier and thereby serves as an actuating member for the indexing lever 50. Angular section 55 has two parallel angular walls 55*a* and 55*b* which engage the downwardly extending portion of

pawl 52 during both the inward and outward strokes of the slides carrier so as to effectuate the desired pivotal movement. The engagement of the actuating member with angular section 55 of the camway causes the indexing lever to be pivotally moved through an arcuate extent corresponding to the distance between two adjacent teeth in the slide tray indexing rack during both the withdrawal and insertion strokes of the slide carrier 16. As shown in the drawings lever 50 is T-shaped with the enlarged portion disposed substantially parallel to the direction of movement of the slide tray. The enlarged portion increases the strength of the lever to prevent twisting thereof during reciprocal movement of the slide carrier. However, it should be noted that other shapes are equally suitable, including a uniformly wider lever.

FIGS. 11 through 14 illustrate the various positions of the indexing lever 50 during the inward and outward reciprocal strokes of the slide carrier 16. As shown in FIG. 11 upon initial withdrawal of slide carrier 16 to return a slide from the projection gate to the tray, the frictional engagement of the actuating member and the base member 17 of the slide carrier carries the indexing lever 50 therewith a distance corresponding to the length of slot 51 so as to disengage pawl 52 from the teeth of the slide tray. As the slide carrier nears its fully withdrawn position, the actuating member of the indexing lever engages the angularly disposed camway section 55 and is biased by means of angular wall 55*a* into the position shown in FIG. 12, which places pawl 52 in alignment with the succeeding tooth on the slide tray indexing rack. Upon initial insertion of slide carrier to transport the next slide into the viewing position, lever 50 is inwardly moved the distance of slot 51 so that pawl 52 reengages the indexing rack of the slide tray. The new position of the lever 50 is shown in FIG. 13. Continued insertion of slide carrier 16, as shown in FIG. 14, results in the engagement of the angular wall 55*b* and the actuating member of the indexing lever 50 so as to pivotally transport the lever 50 to its starting position shown in FIG. 10. Such pivotal movement causes pawl 52 to move the slide tray a sufficient distance to place the next slide receiving space of the slide tray in position for engagement with the pusher arm of the slide carrier.

FIGS. 15 and 16 illustrate the same basic embodiment as shown in FIGS. 10 through 14, with the inclusion of means to implement both forward and reverse advancement of the slide tray. The indexing lever 50 adapted for forward and reverse selective operation shown in FIGS. 15 and 16 is identical to the indexing lever shown in FIGS. 10 to 14. However, camway 54 is provided with an enlarged section 60 defined in part by symmetrical angular walls 61 and 62 and by slots 61*a* and 62*a*. The forward or reverse mode of operation is accomplished by means of a guide member 64 which is pivotally mounted on top of the base member 17 of the slide carrier adjacent the enlarged section 60 of the camway by means of a pin 65. The guide member 64 has a triangular shaped leading section 66, the sides of which selectively cooperate with the angular slotted camways for the actuating member mounted on indexing lever 50, wall 62, triangular section 66 and slot 62*a* defining an angular camway for forward operation as shown in FIG. 15, and wall 61, triangular section 66 and slot 61 *a* defining an angular camway for reverse operation as shown in FIG. 16. A downwardly extending pin 67 is mounted at the rear of guide member 64 and extends through a transverse slotted opening 69 formed in the base member 17 of the slide carrier. A control bracket 63 is slidably disposed beneath base member 17 of the slide carrier for reciprocal movement in a plane substantially perpendicular thereto to selectively move the guide member 64 into position for either forward or reverse operation. The control bracket is formed with longitudinal central slot 68 having two entrance cam surfaces 70 and 71 symmetrically disposed about said slot. Downwardly extending pin 67 mounted on guide member 64 is adapted to selectively engage either cam 70 or 71 to pivotally move the guide member into the desired position to define an angular camway for forward or reverse operation. When the control bracket 63 is in the position shown in FIG. 15, withdrawal of the slide carrier 16 causes pin 67 to engage cam section 71, thereby pivotally moving guide member 64 into the forward operating position, in which the indexing lever 50 is pivotally moved in the manner described with respect to FIGS. 10 and 14. When the control bracket 63 is moved into the position shown in FIG. 16 cam section 70 engages pin 67 to pivotally move guide member 64 into the opposite position to effectuate reverse advancement of the slide tray. As described hereinabove with respect to the embodiment shown in FIGS. 8 and 9, the control bracket 63 can be connected by suitable linking means to an electro-magnetic solenoid or to a mechanical linkage accessible from the exterior of the projector to permit the operator to manually select the desired mode of operation.

The embodiments described hereinabove are included for illustrative purposes only and are in no way intended to limit the scope of the present invention. Additional modifications of the instant indexing mechanism which fall within the scope of this invention will be apparent to those skilled in the art. For example, in each of the forgoing embodiments the indexing lever can be pivotally and slidably mounted below the slide carrier and the pawl can extend upwardly through the slotted camway to also serve as the actuating member. Such an arrangement is shown in FIG. 17, in which an indexing lever 80 is mounted within an identation 81 formed in the base 1 of the projector. A pawl 82 is mounted at one end of the lever and extends upwardly through a slotted camway 83 formed in the base member of slide carrier 84. The pawl is of sufficient length to sequentially engage the indexing teeth of a slide tray installed thereabove, while its engagement with camway 83 permits it to serve as an actuating member. This arrangement is equally adaptable for use with each of the embodiments described hereinabove.

As a further modification, the indexing means can be provided with means to selectively reduce or increase the extent of pivotal movement of the indexing lever and/or the pawl, so that slide trays of differing distances between adjacent slide receiving spaces can be accomodated. A camway with an adjustable angular position, similar in concept to the forward-reverse selection means shown in FIGS. 15 and 16 can be provided for this purpose, and the construction of such means will be apparent to those skilled in the art.

What is claimed is:

1. In a slide projector of the type including a slide tray receiving groove for holding a slide tray having a plurality of slide receiving spaces, and a slide carrier

slidably disposed for reciprocating movement transversely to the slide tray receiving groove, for transferring a slide from a slide tray installed therein to the viewing position on the optical axis of the projector and returning the same to the slide tray, a slide tray indexing mechanism for incrementally advancing the slide tray to sequentially present each slide contained in the slide receiving spaces for viewing comprising, in combination, an indexing lever slidably and pivotally mounted on the projector adjacent said tray receiving groove having a pawl at one end adapted for incremental engagement with a rack of indexing projections formed along the periphery of the slide tray; an actuating member attached to the indexing lever for imparting the required movement to said indexing lever; and a camway formed in the slide carrier in operative engagement with said actuating member for longitudinally moving the indexing lever to disengage the pawl from the indexing projections of the slide tray and permitting pivotal movement thereof to align the pawl with the next indexing projection upon withdrawal of the slide carrier from the projector, and for longitudinally moving said indexing lever to engage the pawl with the next indexing projection on the slide tray and pivotally moving said lever through an arcuate extent corresponding to the distance between two adjacent projections on the rack, to advance the slide tray to the next slide position upon insertion of the slide carrier into the projector.

2. An indexing mechanism in accordance with claim **1,** in which the indexing lever is selectively pivotable in a first direction to effectuate forward advancement of the slide tray, and a second direction to effectuate reverse advancement of the slide tray; and in which a forward-reverse control means is provided in operative engagement with said indexing lever to selectively bias the same for pivotal movement in either the first or the second direction.

3. An indexing mechanism in accordance with claim **2,** in which the camway comprises an elongated slot extending longitudinally along a base member of the slide carrier beneath the slide tray receiving groove and having two symmetrical angular sections corresponding to the first and second directions formed therein; and said forward-reverse control means is adapted to bias the indexing lever in a manner such that the actuating member engages one or the other of said symmetrical angular sections during reciprocating movement of the slide carrier for pivotal movement in either the first or second directions to effectuate forward or reverse advancement of the slide tray, respectively.

4. An indexing mechanism in accordance with claim **3,** in which the forward-reverse control means comprises a slidable bracket extending transversely of the slide carrier and adapted to engage the indexing lever upon withdrawal of the slide carrier to bias the same into engagement with one of the two symmetrical angular sections in the camway.

5. An indexing mechanism in accordance with claim **4,** in which the forward-reverse control bracket has a pair of lugs adapted to selectively engage the innermost end of the indexing lever upon withdrawal of the slide carrier to effectuate pivotal movement in the first or second direction.

6. An indexing mechanism in accordance with claim **3,** in which the forward-reverse control means comprises a guide member pivotally mounted on the base member of the slide carrier adjacent the symmetrical angular sections having a traingular shape leading section the sides of which selectively cooperate with said symmetrical angular walls to form angular slotted camways for the actuating member; one such slotted camway being for forward operation and the other being for reverse operation; and a control bracket slidably disposed beneath the base member of the slide carrier for reciprocal movement in a plane substantially perpendicular thereto to selectively move the guide member into position for either forward or reverse operation.

7. An indexing mechanism according to claim **1,** in which the indexing lever is formed with an axial slot near the end thereof opposite the pawl and is mounted on the base of the slide projector beneath the slide tray receiving groove by means of a pin which slidably engages such slot.

8. An indexing mechanism according to claim **7,** in which the longitudinal slot is disposed in axial alignment with the pawl.

9. An indexing mechanism according to claim **1,** in which the indexing lever is mounted above a base member of the slide carrier.

10. An indexing mechanism according to claim **9,** in which the actuating member of the lever is a downwardly extending projection fixably disposed on the indexing lever in alignment with the pawl.

11. An indexing mechanism according to claim **1,** in which the indexing lever is mounted below a base member of the slide carrier.

12. An indexing mechanism according to claim **11,** in which the pawl extends upwardly and engages the camway to also serve as the actuating member.

13. An indexing mechanism in accordance with claim **1** in which the camway is formed as an integral part of a base member of the slide carrier slidably disposed beneath the slide tray receiving groove.

14. An indexing mechanism according to claim **13,** in which the camway comprises an elongated slot extending longitudinally along said base member of the slide carrier and has at least one section thereof disposed at an angle with respect to the longitudinal axis of the slide carrier, so that engagement of the angular section by the actuating member of the indexing lever during reciprocating movement of the slide carrier effectuates pivotal movement of such lever.

15. An indexing mechanism according to claim **14,** in which the angular section of the camway is formed as a part of the elongated slot and has the same width thereof, so that the relative movement between the slide carrier and the actuating member of the lever effectuates the desired pivotal movement during both the withdrawal and insertion strokes of the slide carrier.

16. An indexing mechanism according to claim **14,** in which the angular portion of the camway comprises an enlarged section of the elongated slot having at least one angular wall which effectuates pivotal movement of the lever only during the insertion stroke of the slide carrier; and in which projection is fixedly disposed on the slide carrier adjacent the innermost end of the camway to engage the innermost end of the indexing lever upon withdrawal of the slide carrier to effectuate pivotal movement thereof when the actuating member is in alignment with the enlarged section of the camway.

17. An indexing mechanism in accordance with claim 16, in which the projection is a lug fixedly mounted to the base member of the slide carrier positioned off center with respect to the camway, so that its engagement with the innermost end of the indexing lever creates a moment to pivotally move the same.

18. An indexing mechanism according to claim 1, in which the slide carrier, the camway and the indexing lever are dimensioned to cooperate with one another in a manner such that the slide tray is advanced to the next position only after the previously viewed slide is fully returned to its appropriate slide receiving space within the slide tray.

19. An indexing mechanism according to claim 1, further comprises detent means disposed on the base of slide projector to engage the teeth of the indexing rack of the tray and maintain the same in the selected position.

20. In a slide projector, reversible indexing mechanism for incrementally advancing a slide tray having a plurality of indexing projections formed along the periphery thereof comprising, in combination an indexing lever mounted on the base of the projector adjacent said tray for reciprocal movement transverse to the direction of movement of said tray and selective pivotal movement parallel to the direction of movement of said tray in either a first direction corresponding to forward advancement of the slide tray or a second direction corresponding to reverse advancement of the slide tray; a pawl fixedly disposed on the lever for engagement with said indexing projections; a slide carrier slidably disposed for reciprocating movement transverse to the slide tray for transferring slides from the tray to the viewing position in the projector upon insertion thereof, and returning the same to the slide tray upon withdrawal thereof; said slide carrier having a base member disposed adjacent said indexing lever, and a camway formed in said base member in operative engagement with said indexing lever for longitudinally moving the indexing lever to disengage the pawl from the indexing projection on the tray and permitting pivotal movement thereof to align the pawl with the next indexing projection on the tray upon withdrawal of the slide carrier, and for longitudinally moving said indexing lever to engage the pawl with said next projection and pivotally moving said lever through an arcuate extent corresponding to the distance between two adjacent projections to advance the slide tray upon insertion of the slide carrier; and a forward-reverse control means in operative engagement with said indexing lever to selectively bias the same for pivotal movement in either the first or second direction.

21. An indexing mechanism according to claim 20, in which the camway comprises an elongated slot extending longitudinally along the base member of the slide carrier and having two symmetrical angular sections corresponding to the first and second directions of pivotal movement of the indexing lever; and said forward-reverse control means comprises a slidable bracket adapted to engage the indexing lever to bias the same into operative engagement with one or the other of said angular sections during reciprocating movement of the slide carrier to effectuate pivotal movement in either the first or second directions.

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