

PATENT SPECIFICATION

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(54) SLIDE PROJECTOR

(71) We, FRANKE & HEIDECHE G.M.B.H., a German Body Corporate, trading as Rollei-Werke Franke & Heidecke, of 196 Salzdhumerstrasse, Braunschweig, Germany, 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 present invention relates to a slide projector with two associated projection units each having a slide carrier and situated side by side and with an alternating ejector movable transversally to the optical axes of the projection units.

In a known slide projector of the aforementioned kind a fading operation is carried out in which the projected images of successive slides smoothly give place to one another without any visually disturbing transition. While one slide is being projected by one lens the preceding slide is removed from its alignment in relation to the other lens and replaced by the next slide. In an image changing operation the illumination of the projected slide is gradually reduced while that of the slide aligned in respect of the other lens is increased to projection intensity, so that the projected image of the first slide gradually fades and that of the subsequent slide at the same time becomes visible.

Most known slide projectors of the kind mentioned at the beginning suffer from the necessity of alternating the projection position of the successive slides, from the unpractical arrangement of the slides in two different magazines and from the resulting alternating arrangement of these slides in accordance with the desired projection sequence. A device has therefore been proposed for the alternating extraction of successive slides from one single magazine, the slides then being moved into two alternating projection positions. This device, however, calls for a fairly complicated and unpractical construction, which suffers from the additional drawback that the slides cannot be deposited in the

correct order, so that the magazine has to be re-opened after each projection.

Fading projectors have also become known which operate with a magazine between the two projection axes but with which the slides have to be removable from the slide magazine in two directions.

According to the present invention there is provided a double projector for projecting photographic slides, comprising two objective lenses, two slide carriers each associated with a respective one of the objective lenses and disposed for movement in a direction substantially transverse to the direction of movement of a slide into or out of a common slide magazine locatable adjacent the side of one slide carrier remote from the other slide carrier, at least one illumination system associated with the slide carriers, so that its optical axis is parallel to the direction of movement of the slide carriers and a slide exchange unit including a slide gripper for removing the slides from the slide magazine in a fixed order and feeding them alternately to one slide carrier or to the other slide carrier and which arranges them in the magazine in the same order, consecutive pairs of slides being presentable simultaneously in the slide carriers for a portion of a slide changeover operation, wherein the slide carriers are movable in said direction of movement thereof so as to move alternately to a slide exchange location and to the focal plane of the respective objective lens associated with each slide carrier, the slide exchange location and the focal plane being remote from one another by at least the structural length in the longitudinal direction of the at least one illumination system.

One embodiment offers the advantage that the slide in one slide carrier, after the fading, can be returned into the magazine, in a horizontal direction, behind the other slide carrier so that known projector magazines most frequently used in practice, can continue to be used, without any sorting operations.

The invention enables each slide carrier

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2 to be rigidly connected to an associated illumination system to form a projection unit. The simultaneous displacement of slide carrier and illumination system enables a condenser of the illumination system to be arranged in the most advantageous manner in respect of the slide picture to be illuminated. When the slide carrier is not permanently combined with the illumination system the condenser in practice has to be over-dimensioned, which means that in order to ensure that the slide picture to be illuminated will not move out of the ray path in the focusing operation the diameter of the condenser has to be made greater from the outset than would be necessary for the focused slide picture.

5 In addition, this structure enables the stopping down or fading to be obtained by simply moving the slide carrier back from the focusing plane of an objective lens into the plane of the alternating ejector. The use of two illumination systems also enables the slide projector to be used both as a panorama or as a stereo projector. In panorama projection both pictures are simultaneously projected side by side onto the screen.

10 A further development of the invention provides an illumination system for both slide carriers, which is movable transversally to the direction of movement of the slide carriers. This arrangement enables one illumination system to be saved and renders the slide projector as a whole more compact.

15 In dimensioning this single illumination system for the slide projector, care should be taken to ensure that the condenser of the illumination system, in a fading process, will illuminate at least a half of each of two slides mounted in the slide carriers respectively. This ensures more or less constant brightness of illumination on the projection screen in the fading process.

20 In a further development of the invention a slide guide is provided on a first slide carrier at one end thereof opposite to that end associated with a slide and situated between the magazine and the second slide carrier; in order to guide a slide from the magazine to the second slide carrier. This slide guide, in accordance with the shape of the slide carriers, is so designed that one of its sides extends almost to the magazine and its second side almost to the second slide carrier. This greatly facilitates and simplifies the transportation of the slides by the aid of the alternating inserter and ejector.

25 It is usual to provide an axially displaceable stop which is located in the region of the focusing plane of the respective stationary objective lens of each slide carrier for adjusting the axial position of the slide carriers. By means of this stop, adjust-

able in the axial direction, the slide to be projected is focused by means of an automatic focusing device.

30 In a further embodiment of the invention the stop is preferably situated between the slide carriers and the objective lenses of the projector. This ensures fully efficient utilization of the space available between the slide carriers and the lenses; and no additional stop lugs have to be provided on the slide carriers.

35 In one advantageous embodiment of the invention, there is provided a drive and control device for the axial displacement of the slide carriers both into the region of the focusing plane of said objective lenses and into the focusing position. In this case the automatic focusing device acts on the axially displaceable stop in such a way that the minor displacements required for the final focusing can be effected by means of an automatic focusing motor. As the projection unit is in any case made displaceable axially in respect of the optical axis, for the purpose of changing the slides, the focusing does not necessitate any axially displaceable mounting of the lens, over and above existing screw threading.

40 To enable the slide projector to be driven in a simple manner, the projector is mechanically controllable, in accordance with a program, by the aid of gearing connections. This enables all control and drive functions called for in a given program to be performed with one drive motor.

45 According to a further embodiment of the invention, the projector is controllable by the aid of electrical drive elements. This version is particularly advantageous when the slide projector, in addition to the fading function, is required to perform further functions, such as those of a panorama or stereo projector.

50 Preferably, in the mechanical control of the slide projector the drive device comprises three discs mounted on a drive motor shaft, two of the discs being control cams for driving an alternating ejector and an alternating inserter respectively via toggle levers, while the third disc, is an eccentric disc for driving the slide carriers by the aid of two toggle levers each of which rotate in opposite directions and each of which is coupled to a slide carrier via sliding guides. The provision of the three superimposed discs on one drive shaft of a drive motor running in forward and reverse directions fulfils all the mechanical drive functions required for a fading process.

55 To control the stepping of the magazine in the forward and in the reverse direction alternately, a control device comprises an additional disc which is situated on the drive motor shaft and which by the aid of two parallel secants displaces in a direction

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parallel to the direction of movement of the slide carriers a lever arm of a switch claw rotatably mounted on a slider and displaceable between two springs, the slider being mounted in a pin-and-slot guide and held and guided in a neutral position by means of two springs acting in opposite directions to each other in a direction parallel to the slot and being provided adjacent the fulcrum for the switch claw with a stop lug for engaging the alternating inserter, while at the opposite end of the slider and at right angles to the direction of the slot the slider is provided with a guide track for one end of a rocker lever mounted between the paths of movement of the slide carriers and movable into two different angular positions by means of lugs provided on the slide carriers. The displacement of the switch claw according to whether the single drive motor is running forwards or in reverse at the same time determines the direction, forwards or in reverse as the case may be, of the magazine stepping movement. Owing to this apparatus the direction of the latter movement does not have to be controlled by an additional relay.

To ensure that the compartment of the magazine which is situated in the plane of the alternating pusher will always be the one corresponding to the next program step, the length and the angle of movement of one rocker lever are selected to ensure that during movement of that one end of the rocker lever associated with the guide track towards the slider, in conjunction with the lugs on the slide carriers, and when one of the two slide carriers moves out of the focusing plane into the plane of the alternating ejector, the lever will effect movement of the magazine in a direction opposite to its feed direction by one step. On the reversal of the driving direction, e.g. upon the transition from the order in which the slides have been projected to the repeated projection of the slides in reverse order, the rocker lever will omit the above mentioned one step correction of the magazine.

Therefore there may be provided a slide projector with a device for fading two successive slides in the course of a slide change operation, so that use can be made of a magazine from which the slides can only be removed towards one side, and into which they can be fed from one side, while its fading device can be constructed on simple and particularly practical lines.

Constructional embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:—

Fig. 1 shows a lateral view of a slide projector, opened up and in one of two slide changing positions;

Fig. 2 shows a plan view of the slide projector of Fig. 1;

Fig. 3 shows a plan view of a drive and control device for the slide changing operation, the magazine stepping movement and the axial movement of the projection units of the slide projector of Fig. 1; and

Fig. 4 shows a slide projector as seen from above, with two slide carriers and one illumination system displaceable transversally to the optical axes of the projector units.

Figs. 1 and 2 show a slide 1 in a first slide carrier 3 and a slide 2 in a second slide carrier 4. The slide carriers 3 and 4 are rigidly connected to the illumination systems 5 and 6. The illumination systems 5 and 6 consist of known elements, such as a parabolic mirror, lamps 16, 17 a first condenser, a heat absorption filter and a second condenser. The illumination systems 5 and 6 are arranged so as to be displaceable, with the respective slide carriers 3 and 4, in the axial direction in respect of the optical axis of the illumination system. For projection units 7 and 8 lenses 9 and 10 are provided respectively, in the direction of projection. A magazine 11 is likewise provided parallel to the projection units 7 and 8 and in the same place. In addition to the magazine and its guide track 12 are operating switches for the forward and reverse movement of the projection units, a release 18 and the lamp switch.

Behind the projection unit 7, and on a level with an alternating ejector 13, is an additional slide guide 14. This slide guide 14 serves to make the slide 2 more easily transportable into the compartment "O". The projection units 7 and 8 are locked in a projection position by means of an axially displaceable stop 15. This stop 15 is displaceable in the axial direction by an automatic focusing device, via mechanical or electrical connection devices.

The operation of the slide projector shown in Figs. 1 and 2 will be described in detail below:

In the position shown the slide 1 is projected by means of the illumination system 5 and via the lens 9 on a projection screen not shown in the drawing (the rays taking the path shown by the dot-and-dash lines). The slide carrier 3 rests against the stop 15, which is responsible for the focusing of the slide. The stop 15 operates in conjunction with one of the usual automatic focusing devices in such a way that the slide comes to rest in the focusing plane of the lens 9.

The projection unit 8, on the other hand, occupies the position which is axially farther back, so that the slide 2 can be transported from the slide carrier 4, by the aid of the

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alternating ejector 13 and via the slide guide 14, past the rear of the illumination system 5, into the magazine 11, i.e. into the compartment "O". After the slide 2 has been deposited in the compartment "O", the magazine 11 is moved two steps forwards, by mechanical gearing elements to be described in detail in due course, so that the compartment "II" comes to rest in the plane of the alternating ejector 13. The alternating inserter 19 (Fig. 3), not shown in Fig. 2, in order to render the latter clearer, takes up a slide from the compartment "II" and transports it via the slide guide 14, past the projection unit 7, into the slide carrier 4, in front of the projection unit 8.

On the next step the projection unit 8 moves forward together with the "new" slide from the compartment "II" into the projection position shown in broken lines. In this process the projection unit 8 moves against the stop 15 and is then conveyed, by the aid of the automatic focusing device interacting with the stop 15, into the focusing plane of lens 10.

The "fading" of the first projected slide into the second slide now takes place in such a manner that the lamp 16 and the projection unit 8 lights up at the same rate as the lamp 17 and the projection unit 7 darkens. The observer thus sees a picture projected onto the screen with an invariably constant degree of brightness, one picture disappearing (that of slide 1) and the other appearing in continually sharper contours. At the end of the fading process the lamp 16 is fully on and the lamp 17 is off.

The projection unit 7 can now be thrust backwards in the axial direction, together with the slide 1, in which process the magazine is at the same time moved backwards by one step, so that the compartment "I" comes to rest in the plane of the alternating ejector. The carrier 3, together with its slide 1, is now situated directly in front of the compartment "I". The alternating ejector 13 now moves past the projection unit 8 and conveys the slide 1 into the compartment "I". When this has been done the magazine 11 is moved forwards by a further two steps, by mechanical gearing elements to be explained in due course, so that the compartment "III" comes to rest in the plane of the alternating ejector 13. The alternating inserter 19 (Fig. 3), not shown in the drawing, conveys the "new" slide from the compartment "III" into the slide carrier 3 of the projection unit 7. The projection unit 7 then moves forward axially, along the optical axis, as far as the stop 15, after which, as described above, it is moved back with its new slide into the focusing plane by means of the focusing device, not shown in the drawing, and the stop 15.

After a further fading process, in which

the picture of the slide in the carrier 3 instead of that of the slide in the carrier 4 appears on the screen, the projection unit 8 moves back in the axial direction into the position shown in Fig. 2. The slide changing process takes place cyclically, in the manner described in the foregoing.

In place of the alternating increase and reduction in the illumination of the lamps 16 and 17 in the fading process the slide projector can also be so designed that both lamps are continuously on. In this case the fading takes place when the projection units are displaced in the axial direction into the projection position. In order to ensure, here again, that the observer will always see a picture of constant brightness on the projection screen, one projection unit must move out of its own focusing position before the other projection unit occupies its own focusing position. With this type of fading the axial displaceability of the projection units 7 and 8 is utilised for the fading process.

When the slide projector is reversed, i.e. when the slides which have just been shown, in the manner described above, are required to appear once again on the screen, in the reverse order, the same processes takes place as in the forward direction, but in reverse. To interrupt the exhibition of a slide, i.e. to convey all the slides back into the magazine from the projection units, the release switch 18 is actuated. The release switch 18, when actuated, blocks the alternating inserter 19 shown in Fig. 3. The sequence of operations for the release is then the same as in the forward projection. The alternating inserter 19 is merely prevented from again conveying slides out of the magazine 11. The slides from the projection units 7 and 8 are thus conveyed in succession and in the correct order into the still vacant compartments in the magazine 11.

Fig. 3 provides a schematic diagram of a possible version of a gearing for this slide projector described in Fig. 2. The items marked 7 and 8 are again the projection units displaceable parallel with each other and axially in the direction of the optical axis. The projection unit 7 is displaced axially, in the direction of the optical axis, by a cam disc 22 eccentrically mounted on drive motor shaft 21, via a sliding guide and via a toggle lever 20 displaceable in the latter by its end. That point on the cam disc 22 which is opposite to that on which the toggle lever 20 acts is subjected to the action of a toggle lever 23, by which the projection unit 8 can be displaced in the direction of the optical axis, likewise via a sliding guide. The projection units 7 and 8 are prestressed by the springs 24 and 25, in order to ensure that the toggle levers 20 and 23 will rest

firmly in the sliding guides.

The drive motor shaft 21 also bears the control cams 26 and 27. For the sake of clarity the eccentric disc 22 has been shown, together with the toggle levers 20 and 23, next to the control cam discs 26 and 27. A broken line indicates the relationship between the separately illustrated parts of the drive motor shaft 21.

The control cam disc 26 drives the alternating ejector 13 via a toggle lever 28, while the control cam disc 27 drives the alternating inserter 19, via another toggle lever 29. The alternating inserter 19 operates in opposition to the force of the spring 30 which is under tension when the said alternating inserter 19 is in the extended position.

The drive shaft 21 also bears a control cam 31, provided with two parallel secants. One secant of this control cam is parallel to the optical axes of the projection units, when the system is in the neutral position, and then displaces, to the left or to the right, according to the driving direction of the drive motor shaft 21, a lever arm 32 of a switch claw 36 rotatably mounted on a slider 33 and displaceable between two springs 34 and 35. The slider 33 rests in a pin-and-slot guide 37 and is held and guided in a neutral position by means of two springs 38 and 39 operating in opposition to each other, in the direction of the slot. The slider 33 also interacts, via a stop lug 40, with a stop 41 of the alternating inserter 19. In the vicinity of the lug 40 the fulcrum of the switch claw 36 is provided on the slider 33. The switch claw 36, when pivoted, moves by its grippers 42 and 43 into the pinions 45 arranged in a circle on drive disc 44 of the magazine. A positioning device 46 prevents incorrect operations of the magazine driven by the magazine drive disc 44. The springs 34 and 35 of the switch claw hold the switch claw 36 in a central position in respect of the magazine drive disc 44 and control cam 31. That end of the slider 33 which is situated opposite to the stop lug 40 is provided with a guide track 47, at right angles to the direction of the slot. One end of a toggle or rocker lever 48, mounted between the optical axes of the projection units 7 and 8, rests against the guide track 47. The other end of the rocker lever 48 interacts with a lug 49 of the projection unit 7. The lug 50 of the projection unit 8 also engages the toggle lever 48 between the fulcrum and that end of the toggle lever 48 which rests against the guide track 47.

The method of operation of this mechanical gearing for the slide projector shown in Figs. 1 and 2 is as follows:

For diagrammatic reasons the projection unit 8 in Fig. 3 is shown in the position indicated by dot-and-dash lines in Fig. 2.

The gearing in Fig. 3 occupies the position shortly before the fading of the slide 1 in the projection unit 7 into the slide 2 in the projection unit 8 (path of rays shown by dot-and-dash lines).

After the fading of the slide 1 into the slide 2 the drive motor shaft 21 is rotated together with the eccentric disc 22 in the forwards direction (V). In this process the eccentric disc 22 displaces the toggle lever 20 in such a way that the projection unit 7 is moved via sliding guides in the direction of the plane of the alternating ejector, in opposition to the force of the spring 25.

Together with the cam disc 22, however, the control cam discs 26 and 27 and the control disc 31 likewise rotate. In a rotation of the control disc 31 in the forwards direction (V) the lever arm end 32 of the switch claw 36 is displaced towards the left, in opposition to the force of the spring 34 of the switch claw, and the switch claw 36 is rotated in such a way that its gripper 42 enters the group of pinions 45 provided on the magazine drive disc 44. On the route taken by the projection unit 7 from the focusing plane into the plane of the alternating ejector the lug 49 moves one end of the rocker lever 48 in a clockwise direction. Owing to the rotation of the rocker lever 48 that end of the rocker lever which faces away from the operating lug slides over the guide track 47 of the slider 33. The slider 33 is thus displaced, in opposition to the force of the slider spring 38, in the direction of the control cam discs 26 and 27, as a result of which the obliquely positioned switch claw 36, at the same time, by the aid of its gripper 42, rotates the magazine drive disc 44, via the pinions 45, by one step in the reverse direction (R). The displacement of the magazine by one step in the reverse direction ensures that the slide 1 will be deposited in the same compartment from which it was previously extracted.

At the beginning of the movement of the projection unit 7 the alternating ejector 13 is moved, by the aid of the control cam disc 26 and the toggle lever 28, approximately as far as the level of the projection unit 8 (shown in dot-and-dash lines). The alternating inserter 19 moves, by the aid of the control cam disc 27 and the toggle lever 29, and in opposition to the force of a spring 30, out of the displacement range of the projection unit 7.

When the slide carrier 3 with the slide 1 has reached the plane of the alternating ejector, the alternating ejector 13 conveys the slide 1, transversally to the optical axis, into the magazine, not shown in this drawing. Simultaneously, the alternating inserter 19 moves, with its attachment 41, in the same direction as the alternating ejector 13. Therefore after the slide 1 has been

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deposited in the magazine by the ejector 13 the attachment 41 of the inserter 19, during the final part of its outward movement, makes impact against the stop lug 40 on the slider 33. The slider 33 thus moves the magazine shown in Fig. 2 in the forward direction by two steps, via the switch claw 36, the gripper 42, the pinions 45 and the magazine drive disc 44. Two steps are required because the next compartment, not shown in the drawing, has already been evacuated for the projection unit 8.

The alternating inserter 19 now takes up the "new" slide and conveys it into the slide carrier 3 of the projection unit 7. In this process the slider 33 and the switch claw 36, by the aid of the springs 38 and 39 of the slider and the springs 34 and 35 of the switch claw, return to their neutral positions, because the other secant of the control disc 31 becomes operative. In the second quarter-rotation of the eccentric disc 22 the projection unit 7, by the aid of the toggle lever 20, moves back into the zone of the focusing plane. Here it is positioned, by the axially displaceable stop 15, in the outermost position, as viewed in the projection direction, of the focusing range. The fine adjustment of the projection unit 7 with the "new" slide contained in the carrier 3 now takes place in the direction of the plane of the alternating ejector, in opposition to the force of the spring 25, by means of an automatic focusing device which is not shown in the drawing and by which the stop 15 is displaced until the slide comes to rest exactly in the focusing plane.

By the darkening of the lamp 16 and the brightening of the lamp 17 fading takes place, so that on a further rotation of the drive shaft 21 the projection unit 8 is displaced, by the aid of the eccentric disc 22 and the toggle lever 23, and in opposition to the force of the spring 24, in the direction of the plane of the alternating ejector. In this process the lug 50 displaces the rocker lever 48 in an anticlockwise direction and the magazine is moved by one step in the reverse direction (R), via the known elements described above, guide track 47, slider 33, switch claw 36, gripper 42, pinions 45 and magazine drive disc 44. The empty magazine compartment belonging to the slide 2 is thus situated in the plane of the alternating ejector.

In the next step the alternating ejector 13 pushes the slide 2 out of the slide carrier 4 and, via the slide guide 14 situated behind the projection unit 7, into the empty compartment in the magazine, the latter not being shown in the drawing.

After the slide 2 has been deposited in the magazine the alternating inserter 19 is once again moved outwards, so that its attachment 41, via the stop lug 40, the slider 33,

the switch claw 36, the gripper 42, the pinions 45 and the magazine drive disc 44, displaces the magazine by two steps in the forward direction (V) (as shown by the double arrow). On the further rotation of the control cam disc 27 the alternating inserter 19, by the aid of the toggle lever 20 and the spring 30, once again conveys the second "new" slide, via the slide guide 14 behind the projection unit 7, into the slide carrier 4 of the projection unit 8. The projection unit 8 is now displaced axially along the optical axis, as far as the displaceable stop 15, by the aid of the spring 24 and in accordance with the guiding of the toggle lever 23 and the eccentric disc 22. The focusing, as in the previous process, described in connection with the projection unit 7, is carried out in the direction of the plane of the alternating ejector, by the displacement of the stop 15. After the "new" second slide is situated in the focusing plane, a fading can once again be effected into this slide and a further projection cycle can commence.

The release switch 18 is pressed in order to terminate the slide projection program and cause the slides present in the slide carriers to be returned to the magazine. This release switch 18, via mechanical or electrical connecting devices, causes the alternating inserter 19 to be locked against movement. This ensures that when the motor drive shaft 21 is actuated all the drive operations described in the foregoing will take place in the same manner in the release process. No further new slides, however, will be conveyed out of the magazine, because the alternating inserter 19 is locked in the insertion direction. It is locked in such a way that its attachment 41 is situated in the immediate vicinity of the stop lug 40 of the slider 33. After a complete rotation of the drive shaft 21 all the slides have been removed from the projection units 7 and 8 and can be extracted in the correct order, together with the magazine, from the slide projector.

In a further version of the invention the slide projector consists of two slide carriers and an illumination system displaceable transversally to the optical axes (Fig. 4). All other elements, such as the lenses 9 and 10, the magazine 11, the alternating ejector 13 and the stop 15 axially displaceable in respect of the optical axes are provided in the same way as in the slide projector shown in Figs. 1 to 3. The slide carriers 3 and 4, however, are displaceable axially along the optical axes, separately from the illumination system 51. The illumination system 51 is so dimensioned that when it is displaced transversally to the optical axes, in the fading process, in the position between the two optical axes, it will illuminate, at least to the

extent of one half, both the slides present in the slide carriers 3 and 4. This ensures that the projected picture, in the fading process, will only be slightly altered in brightness.

5 In order to ensure a satisfactory fading effect in this apparatus, the slide carriers 3 and 4 must be situated as close together as possible. This also enables the diameter of the illumination system 51 to be kept small.

10 The operation of this slide projector is essentially the same as in the case of that described in connection with Figs. 1 to 3:

In order to effect the fading from the slide carrier 3 to the slide carrier 4, the illumination system 51 is displaced transversally to the optical axes, by means of mechanical or electrical drive elements. When the central position is reached the condenser 54 covers somewhat more than the lower half of the slide situated in the slide carrier 4 and somewhat more than the upper half of that situated in the slide carrier 3. On a further movement of the illumination system 51, as far as the stop 52, the complete fading to the slide situated in carrier 4 takes place.

On the next step the slide carrier 3 moves back axially, past the illumination system 51, into the plane of the alternating ejector. The alternating ejector 13 then conveys the slide from the carrier 3 into the magazine 11, and an alternating inserter not shown in the drawing extracts the "new" slide, in accordance with the corresponding stepping movements of the magazine 11, out of the latter, inserting it in the carrier 3. When the carrier 3 has been loaded with the "new" slide, it moves axially forwards, as far as the axially displaceable stop 15. After a further fading operation, by the transversal displacement of the illumination system 51 as far as the fixed stop 53, the slide carrier 4 can be moved axially backwards into the plane of the alternating ejector. In this position the alternating ejector 13 once again takes up the slide situated in the slide carrier 4 and conveys it via the slide guide 14, which is situated behind the illumination system 51, into the magazine 11. The magazine 11 is moved forwards by the corresponding step, and the alternating inserter, not shown in the drawing, conveys the "new" slide, via the slide guide 14, into the slide carrier 4, after which this latter can once again be moved forwards in the axial direction.

55 The release process, i.e. the termination of the slide projection, is carried out as in the case of the slide projector described in conjunction with Figs. 1 to 3. The slide projector last described offers the advantage of a more compact construction.

WHAT WE CLAIM IS:—

1. A double projector for projecting photographic slides, comprising two object-

ive lenses, two slide carriers each associated with a respective one of the objective lenses and disposed for movement in a direction substantially transverse to the direction of movement of a slide into or out of a common slide magazine locatable adjacent the side of one slide carrier remote from the other slide carrier, at least one illumination system associated with the slide carriers, so that its optical axis is parallel to the direction of movement of the slide carriers and a slide exchange unit including a slide gripper for removing the slides from the slide magazine in a fixed order and feeding them alternately to one slide carrier or to the other slide carrier and which arranges them in the magazine in the same order, consecutive pairs of slides being presentable simultaneously in the slide carriers for a portion of a slide changeover operation, wherein the slide carriers are movable in said direction of movement thereof so as to move alternately to a slide exchange location and to the focal plane of the respective objective lens associated with each slide carrier, the slide exchange location and the focal plane being remote from one another by at least the structural length in the longitudinal direction of the at least one illumination system.

2. A projector as claimed in claim 1, wherein each slide carrier is rigidly connected to an illumination system to form a projection unit.

3. A projector as claimed in claim 1 or 2, wherein a slide guide is provided on a first slide carrier at one end thereof opposite to that end associated with a slide and situated between the magazine and the second slide carrier, the said slide guide serving to guide a slide from the magazine into the second slide carrier.

4. A projector as claimed in Claim 1, wherein one illumination system is provided for both slide carriers and is movable transversally to the direction of movement of the slide carriers.

5. A projector as claimed in Claim 4, wherein the illumination system is so dimensioned that in a fading process it illuminates at least one half of each of two slides mounted in the slide carriers respectively.

6. A projector as claimed in any of the preceding Claims, further comprising an axially displaceable stop located in the region of the focusing plane of the respective stationary objective lens for adjusting the axial position of the slide carriers.

7. A projector as claimed in Claim 6, wherein the stop is situated between the slide carriers and objective lenses.

8. A projector as claimed in any of the preceding Claims, further comprising drive and control devices for the axial displace-

extent of one half, both the slides present in the slide carriers 3 and 4. This ensures that the projected picture, in the fading process, will only be slightly altered in brightness.

In order to ensure a satisfactory fading effect in this apparatus, the slide carriers 3 and 4 must be situated as close together as possible. This also enables the diameter of the illumination system 51 to be kept small.

The operation of this slide projector is essentially the same as in the case of that described in connection with Figs. 1 to 3:

In order to effect the fading from the slide carrier 3 to the slide carrier 4, the illumination system 51 is displaced transversally to the optical axes, by means of mechanical or electrical drive elements. When the central position is reached the condenser 54 covers somewhat more than the lower half of the slide situated in the slide carrier 4 and somewhat more than the upper half of that situated in the slide carrier 3. On a further movement of the illumination system 51, as far as the stop 52, the complete fading to the slide situated in carrier 4 takes place.

On the next step the slide carrier 3 moves back axially, past the illumination system 51, into the plane of the alternating ejector. The alternating ejector 13 then conveys the slide from the carrier 3 into the magazine 11, and an alternating inserter not shown in the drawing extracts the "new" slide, in accordance with the corresponding stepping movements of the magazine 11, out of the latter, inserting it in the carrier 3. When the carrier 3 has been loaded with the "new" slide, it moves axially forwards, as far as the axially displaceable stop 15. After a further fading operation, by the transversal displacement of the illumination system 51 as far as the fixed stop 53, the slide carrier 4 can be moved axially backwards into the plane of the alternating ejector. In this position the alternating ejector 13 once again takes up the slide situated in the slide carrier 4 and conveys it via the slide guide 14, which is situated behind the illumination system 51, into the magazine 11. The magazine 11 is moved forwards by the corresponding step, and the alternating inserter, not shown in the drawing, conveys the "new" slide, via the slide guide 14, into the slide carrier 4, after which this latter can once again be moved forwards in the axial direction.

The release process, i.e. the termination of the slide projection, is carried out as in the case of the slide projector described in conjunction with Figs. 1 to 3. The slide projector last described offers the advantage of a more compact construction.

WHAT WE CLAIM IS:—

1. A double projector for projecting photographic slides, comprising two object-

ive lenses, two slide carriers each associated with a respective one of the objective lenses and disposed for movement in a direction substantially transverse to the direction of movement of a slide into or out of a common slide magazine locatable adjacent the side of one slide carrier remote from the other slide carrier, at least one illumination system associated with the slide carriers, so that its optical axis is parallel to the direction of movement of the slide carriers and a slide exchange unit including a slide gripper for removing the slides from the slide magazine in a fixed order and feeding them alternately to one slide carrier or to the other slide carrier and which arranges them in the magazine in the same order, consecutive pairs of slides being presentable simultaneously in the slide carriers for a portion of a slide changeover operation, wherein the slide carriers are movable in said direction of movement thereof so as to move alternately to a slide exchange location and to the focal plane of the respective objective lens associated with each slide carrier, the slide exchange location and the focal plane being remote from one another by at least the structural length in the longitudinal direction of the at least one illumination system.

2. A projector as claimed in claim 1, wherein each slide carrier is rigidly connected to an illumination system to form a projection unit.

3. A projector as claimed in claim 1 or 2, wherein a slide guide is provided on a first slide carrier at one end thereof opposite to that end associated with a slide and situated between the magazine and the second slide carrier, the said slide guide serving to guide a slide from the magazine into the second slide carrier.

4. A projector as claimed in Claim 1, wherein one illumination system is provided for both slide carriers and is movable transversally to the direction of movement of the slide carriers.

5. A projector as claimed in Claim 4, wherein the illumination system is so dimensioned that in a fading process it illuminates at least one half of each of two slides mounted in the slide carriers respectively.

6. A projector as claimed in any of the preceding Claims, further comprising an axially displaceable stop located in the region of the focusing plane of the respective stationary objective lens for adjusting the axial position of the slide carriers.

7. A projector as claimed in Claim 6, wherein the stop is situated between the slide carriers and objective lenses.

8. A projector as claimed in any of the preceding Claims, further comprising drive and control devices for the axial displace-



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ment of the slide carriers both into the zone of the focusing plane and also into the focusing position itself.

5 9. A projector as claimed in any of the preceding Claims, wherein it is mechanically controllable, in accordance with a program, by the aid of mechanical connecting elements.

10 10. A projector as claimed in any of Claims 1 to 8, wherein it is controllable by the aid of electrical drive elements.

15 11. A projector as claimed in Claim 8, or Claims 9 or 10 when dependent on Claim 8, wherein the drive device comprises three discs mounted on a drive motor shaft, two of the discs being control cams for driving an alternating ejector and an alternating inserter, respectively, via toggle levers, while the third disc is an eccentric disc for driving the slide carriers by the aid of two toggle levers each of which is rotatable in opposite directions and each of which is coupled to a respective slide carrier via slide guides.

25 12. A projector as claimed in Claim 11, wherein the control device comprises an additional disc which is situated on the drive motor shaft and which by the aid of two parallel secants displaces in a direction parallel to the direction of movement of the slide carriers a lever arm of a switch claw rotatably mounted on a slide and displaceable between two springs, the slider being mounted in a pin-and-slot guide and held

and guided in a neutral position by means of two springs acting in opposite directions to each other in a direction parallel to the slot and being provided adjacent the fulcrum for the switch claw with a stop lug for engaging the alternating inserter, while at the opposite end of the slider and at right angles to the direction of the slot the slider is provided with a guide track for one end of a rocker lever mounted between the paths of movement of the slide carriers and movable into two different angular positions by means of lugs provided on the slide carriers.

13. A projector as claimed in Claim 12, wherein the rocker lever has a length and an angle of rotation which are selected to ensure that during movement of that one end of the rocker lever associated with the guide track towards the slider, in conjunction with the lugs on the slide carriers, and when one of the two slide carriers moves out of the focusing plane into the plane of the alternating ejector, the lever will effect movement of the magazine in a direction opposite to its feed direction by one step.

14. A slide projector substantially as described herein with reference to, and as illustrated by, the accompanying drawing.

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