

PATENT SPECIFICATION (11)

1 403 010

1 403 010

- (21) Application No. 47225/72 (22) Filed 12 Oct. 1972 (19)
 (31) Convention Application No. 8824/71 (32) Filed 12 Oct. 1971 in
 (33) Austria (OE)
 (44) Complete Specification published 13 Aug. 1975
 (51) INT. CL.* G03B 3/02 21/38 21/42
 (52) Index at acceptance
 G2E A20A2 A20C2 A20C5



(54) CINE PROJECTOR

(71) We, KARL VOCKENHUBER, of 118 Potzleinsdorferstrasse, Vienna 18, and RAIMUND HAUSER, of 2 Goldeggasse, Vienna 4, both Austria, both of Austrian Nationality, 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:—

10 This invention relates to a cine projector having a projection lens assembly which is displaceable along its optical axis by a focussing mechanism to vary the sharpness of the projected image.

15 More particularly the invention is concerned with a projector having the facility enabling the sharpness of the image to be improved when the frame frequency of projection is changed.

20 In some film projectors it is desirable not only to project running film but also to stop the film at a particular position to enable a particular frame to be viewed. Throughout this specification the projection of a single frame in this way is referred to as a "still". When the examination of the still is completed the projector is required to revert back to its normal running mode.

30 During projection of a 'still' from a cine film in a cine projector, an emulsion layer of the film is dried out by the heat from the projection lamp and consequently the picture lying in the film gate becomes vaulted. The projected image then loses its definition and adjustment of the lens focus becomes necessary. When the still is followed by projection of the running film once again, a re-adjustment of the lens focus becomes necessary to re-establish the original setting.

40 It has been proposed to overcome the need for a special focussing operation when projecting a still, by energising an electromagnet which alters the focus of the lens during still projection. After the still projection the magnet is deenergized and a setting device for the lens re-establishes the original focus. A relatively high expenditure of structural members and a complicated mechanism for the focussing arrangement are necessary for such a solution and this is naturally disad-

vantageous. In addition, the amount of alteration of focus to project a still is constant and preset and very often it is not always suitable to ensure that the projected image of the still is really sharp.

An alternative proposal has been to provide a plane parallel glass plate which is inserted in the light path between the film gate and the projection lens when projecting a still. Besides the disadvantage of the focus alteration at still projection being fixed there results in a reduction of the light intensity available at still projection which has already been reduced by the insertion of a filter between projection lamp and film gate to project the film.

The invention provides a cine projector having a projection lens assembly displaceable along its optical axis by a focussing mechanism which responds to two controls the first of which is operable for adjustment of the lens assembly position within a predetermined range from its position, which is dependent on the setting of the second control, wherein the first control is connected for simultaneous operation with a mode control switch determining with its setting the transport speed of the film through the projector.

By using the invention the image of a still may be focused sharply irrespective of its position in the film gate and without altering the projection light intensity nor the original focussing of the lens which is immediately and automatically re-established when the projector reverts to its "running" projection mode. Moreover the expenditure for introducing the invention into a projector is relatively small.

In order to reduce the heat directed by the projection lamp in the direction of the film during still projection it is advantageous to mount a heat filter so that it is automatically switched into the path of rays from the projection lens during projection of a still.

Preferably the projector is provided with a manually operable mode selector having a number of different positions, which correspond with different image projection frequencies and vary, accordingly, the amount by which the projection lens focus is varied

for compensating for film vaulting. Thus one extreme working position of the mode selector corresponds to the largest image projection frequency, while the other extreme position corresponds to still projection.

The invention will now be described in more detail, by way of examples, with reference to cine projector embodiments shown in the accompanying drawings, in which:—

Figures 1 and 1A show diagrammatically in section and end view, respectively, a mechanical arrangement for altering the focus of a projected image to accommodate still projection of a film frame;

Figure 2 shows an alternative arrangement in diagrammatic side section;

Fig. 1 shows schematically parts of a cine projector 1, having a lens system 2 for projecting an image of a film 4 illuminated by a light source 3 towards a projection plane, not shown. The casing of the lens system 2 is shiftable in a straight guide fixed to the projector and has a circular groove 5, in which a guide pin 6 fixed to a lever 7 locates without play. The lever 7 has a further pin 8 adjacent its opposite end. Between these two pins a threaded sleeve 10 is pivoted at 9 to the lever 7.

The threaded sleeve 10 is threaded onto a lead screw 11 journaled in the projector casing and which is provided on the front face of the casing with a setting knob 12. The journal of the lead screw 11 in the casing 1 prevents it from displacing axially. The lever 7 is forced by a tension spring 13 fixed to the casing 1 in the direction of the projection place, so that its lower end is resiliently held against a fixed stop 14 providing a heel fulcrum.

At the beginning of cine projection the lens 2 is focused by turning the setting knob 12, which causes shifting of the threaded sleeve 10, along the leadscrew 11. The pivot 9 produces corresponding movement of the lever 7 about the heel fulcrum stop 14. The movement of the lever 7 is transmitted to the lens 2 by the pin 6.

If the cine projector is to project a still, i.e. a stationary selected frame, it is necessary to regain the sharpness of focus which has been lost during the still projection because of the vaulting or bending of the film in the film gate. This restoration of focus is achieved by an arrangement disposed under the setting knob 12 and formed by a lever 15, which is pivoted at 16 and has a lateral projection 17 in immediate vicinity of the pin 8 of the lever 7. One end of the lever 15 projects out of the projector casing 1 and is guided in a slot 18 in the casing wall (see Fig. 1A). As can be seen from Fig. 1A, the lever 15 acts primarily as a frame-frequency control. A rod 19 displaceable transversely of the optical axis of the lens 2 carries a mount 20 in which is a heat filter 21. The

rod 19 is connected at its lower end to the lever 15 and is resiliently biased upwards by a tension spring 22, which is fixed to the casing. The lever 15 is thus resiliently held by this tension spring 22 at the upper end of the slot 18 (related to Fig. 1), which corresponds to the position for normal projection (for instance 18 frames per sec.).

For still projection, the lever 15 is pressed downwards against the action of the tension spring 22 along the slot 18 until it reaches the mark zero on the casing wall. Upon further downward moving to the mark "focus" of the lever 15 the projection 17 bears against the pin 8 of the lever 7 and deflect it towards the left in the Figure so that the end of the lever 7 is eased away from the stop 14. The lever 7 rocks around the axis 9 of the threaded sleeve 10 fixed to the lead screw 11 so that the lens 2 is shifted by an amount sufficient to alter the focussing of the still picture. At the same time the rod 19 connected with the lever 15 introduces the heat filter into the light path extending from the lamp 3 to the lens 2. Upon release of the lever 15, it is restored to its initial position by the action of the spring 22, the filter 21 is lifted out of the light path of rays. The lower end of the lever 7 now returns to the stop 14 and thus the adjustment of the lens 2 restores it to the position it occupied before still projection. Arrangements known *per se* and therefore not illustrated are connected to the lever 15 to change the frame frequency in accordance with the position of the lever 15. For instance, the slot 18 may be calibrated in terms of frequencies of 18 frames per sec., 9 frames per sec., and still projection.

In Figure 2 a lens 25 is provided with a toothed rack-and-segment system 23, 24. During focussing in normal operation the lens 25 bearing the toothed rack 23 is displaced by the toothed segment 24 in the direction of the optical axis. A part 26 bearing the toothed segment 23 is provided with a laterally projecting arm 27 and is pivotally arranged around a fixed axis 29, which also supports a focus setting lever 28. The focus setting lever 28 carries a further pivot 30 on one side to provide fulcrum for a transmission lever 31 which at one end is flexibly pivotted to the end of the arm 27. A pin 32 fixed on the focus setting lever 28 extends through a slot 33 formed in one arm 34 of a bell crank lever 35. The other arm of the bell crank lever 25 resiliently abuts an oblique surface 36 of the part 26 bearing the segment. The bell crank lever 35 is pivotted to turn about a fixed axis 37 so that the part 26, the focus setting lever 28 and the bell crank lever 35 form a sort of quadrilateral bellcrank system.

To focus the lens 35 during normal running, the focus setting lever 28 is moved

downwards and turns around the axis 29. Due to the oblique setting of the slot 33, the arm 34 of the bell crank lever 35 is moved counterclockwise, and the arm abutting the oblique surface 36 is moved downwards. Thus the part 26 bearing the segment 24 is moved to the right and correspondingly shifts the lens 25 by means of the toothed rack 23.

To set the frame frequency, a lever 40 is provided adjacent the focus setting lever 28, and during normal projection the setting lever occupies the dash-lined position 40¹. For still projection, the lever 40 is pressed downwards until a stop 39 of the lever 40 abuts the free end of the transmission lever 31. To obtain the new focussing of the lens for sharper reproduction of the still, the lever 40 is further pressed downwards. The stop 39 then turns the transmission lever 31 clockwise about its fulcrum axis 30 and the motion is relayed through the flexible pivot to the arm 27 of the part 26 bearing the toothed segment 24. The part 26 moves against the bias of the spring 38 to the left and adjusts the lens by the desired amount for still projection. Upon release of the lever 40, it is restored to the position shown in full outline by the force of the spring 38. The original focus setting has thus not been changed, because the position of the pin 32 in the oblique slot 33 remained unaltered. The full outline position of the lever 40 corresponds to zero film frequency and the different frequencies may be denoted as shown by a pointer moving across a dial.

Thus, although the lever 40 acts as a fine-focussing lever for still projection, it is primarily a mode control switch or at least it is directly connected to one. A cam follower or a cam could then be controlled by the position of the lever and control the operation of a film traction claw used to draw the film through the film gate.

Theoretically it would be possible to design the arrangement in such a manner that the lens could be shifted in either direction. Since however in a projector the position of the emulsion layer of the film with respect to the position of the projection lamp is always the same, the film will always bend during a still projection in the same direction. Thereafter readjustment of the lens focussing is only necessary in one direction.

WHAT WE CLAIM IS:—

1. A cine projector having a projection lens assembly displaceable along its optical axis by a focussing mechanism which responds to two controls the first of which is operable for adjustment of the lens assembly

position within a predetermined range from its position, which is dependent on the setting of the second control, wherein the first control is connected for simultaneous operation with a mode control switch determining with its setting the transport speed of the film through the projector.

2. A cine projector as claimed in claim 1, in which the two controls are manually operated mechanical mechanisms.

3. A cine projector as claimed in any one of the preceding claims, in which the first control is resiliently biased towards an inoperative position at which the lens assembly position is determined solely by the second control.

4. A cine projector as claimed in any one of the preceding claims, in which operation of the first control introduces a heat filter into an optical path leading from a projector lamp to a film gate.

5. A cine projector as claimed in any one of the preceding claims, in which the focussing mechanism comprises a lever, which is displaced during operation of the first control.

6. A cine projector as claimed in claim 5, in which the second control is applied to the lever by a leadscrew and a resilient bias urges the lever towards the position it occupies when the first control is inoperative.

7. A cine projector as claimed in any one of claims 1 to 4, in which the focussing mechanism comprises a lever having a fixed pivot and provided with a toothed segment arcuate about the pivot axis and which meshes with a rack on the projection lens.

8. A cine projector as claimed in claim 7, in which the lever is a first bell-crank lever which has one arm slackly pivoted to a transmission lever whose fulcrum is provided by a focussing lever providing the second control and pivoted for rocking movement about the bell-crank lever axis, a second bell-crank lever being provided with a fixed pivot parallel to that of the first bell-crank lever and having its two arms respectively abutting over one arm of the first bell-crank lever and by way of a pin-and-slot linkage the slot of which is inclined to the longitudinal axis of the other arm of the first bell-crank lever, engaging the focussing lever, a resilient bias urging the arms of bell-crank levers into abutment and the first control being provided by movement of a setting lever for film frame frequency to its nil frequency position at which the setting lever bears on the transmission lever to rock it, and thus the first bell crank lever, through a small arc to change the setting of the lens assembly from



downwards and turns around the axis 29. Due to the oblique setting of the slot 33, the arm 34 of the bell crank lever 35 is moved counterclockwise, and the arm abutting the oblique surface 36 is moved downwards. Thus the part 26 bearing the segment 24 is moved to the right and correspondingly shifts the lens 25 by means of the toothed rack 23.

To set the frame frequency, a lever 40 is provided adjacent the focus setting lever 28, and during normal projection the setting lever occupies the dash-lined position 40¹. For still projection, the lever 40 is pressed downwards until a stop 39 of the lever 40 abuts the free end of the transmission lever 31. To obtain the new focussing of the lens for sharper reproduction of the still, the lever 40 is further pressed downwards. The stop 39 then turns the transmission lever 31 clockwise about its fulcrum axis 30 and the motion is relayed through the flexible pivot to the arm 27 of the part 26 bearing the toothed segment 24. The part 26 moves against the bias of the spring 38 to the left and adjusts the lens by the desired amount for still projection. Upon release of the lever 40, it is restored to the position shown in full outline by the force of the spring 38. The original focus setting has thus not been changed, because the position of the pin 32 in the oblique slot 33 remained unaltered. The full outline position of the lever 40 corresponds to zero film frequency and the different frequencies may be denoted as shown by a pointer moving across a dial.

Thus, although the lever 40 acts as a fine-focussing lever for still projection, it is primarily a mode control switch or at least it is directly connected to one. A cam follower or a cam could then be controlled by the position of the lever and control the operation of a film traction claw used to draw the film through the film gate.

Theoretically it would be possible to design the arrangement in such a manner that the lens could be shifted in either direction. Since however in a projector the position of the emulsion layer of the film with respect to the position of the projection lamp is always the same, the film will always bend during a still projection in the same direction. Thereafter readjustment of the lens focussing is only necessary in one direction.

WHAT WE CLAIM IS:—

1. A cine projector having a projection lens assembly displaceable along its optical axis by a focussing mechanism which responds to two controls the first of which is operable for adjustment of the lens assembly

position within a predetermined range from its position, which is dependent on the setting of the second control, wherein the first control is connected for simultaneous operation with a mode control switch determining with its setting the transport speed of the film through the projector.

2. A cine projector as claimed in claim 1, in which the two controls are manually operated mechanical mechanisms.

3. A cine projector as claimed in any one of the preceding claims, in which the first control is resiliently biased towards an inoperative position at which the lens assembly position is determined solely by the second control.

4. A cine projector as claimed in any one of the preceding claims, in which operation of the first control introduces a heat filter into an optical path leading from a projector lamp to a film gate.

5. A cine projector as claimed in any one of the preceding claims, in which the focussing mechanism comprises a lever, which is displaced during operation of the first control.

6. A cine projector as claimed in claim 5, in which the second control is applied to the lever by a leadscrew and a resilient bias urges the lever towards the position it occupies when the first control is inoperative.

7. A cine projector as claimed in any one of claims 1 to 4, in which the focussing mechanism comprises a lever having a fixed pivot and provided with a toothed segment arcuate about the pivot axis and which meshes with a rack on the projection lens.

8. A cine projector as claimed in claim 7, in which the lever is a first bell-crank lever which has one arm slackly pivoted to a transmission lever whose fulcrum is provided by a focussing lever providing the second control and pivoted for rocking movement about the bell-crank lever axis, a second bell-crank lever being provided with a fixed pivot parallel to that of the first bell-crank lever and having its two arms respectively abutting over one arm of the first bell-crank lever and by way of a pin-and-slot linkage the slot of which is inclined to the longitudinal axis of the other arm of the first bell-crank lever, engaging the focussing lever, a resilient bias urging the arms of bell-crank levers into abutment and the first control being provided by movement of a setting lever for film frame frequency to its nil frequency position at which the setting lever bears on the transmission lever to rock it, and thus the first bell crank lever, through a small arc to change the setting of the lens assembly from



1,403,010

the position determined by the pin-and-slot linkage.

9. A cine projector substantially as here-
in described with reference to Figures 1 and
5 1A of Figure 2 of the accompanying draw-
ings.

MARKS & CLERK,
Chartered Patent Agents,
57 & 58 Lincoln's Inn Fields,
London, WC2A 3LS.
Agents for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1975.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.