

PATENT SPECIFICATION

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(54) CINEMATOGRAPHIC PROJECTOR

(71) We, BOLEX INTERNATIONAL S.A., of 18 Avenue des Alpes CH 1450 Sainte-Croix, Switzerland, a Swiss Company, 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:—

This invention concerns a cinematographic projector designed for use with cassettes.

There are known sound tape recorders designed for use with cassettes containing a feed spool, a take-up spool and the magnetic tape, and having a storage compartment for unplayed cassettes above the playing position and a device for transferring the used cassettes into a second compartment.

A cinematographic projector has, in accordance with the present invention, a magazine for accommodating a stack of film cassettes to be consecutively projected, a plate bodily displaceable towards and away from one end of the magazine from which the cassettes are selected consecutively for projection, a take-up spool drive arranged to cooperate with a cassette to be projected when the plate is displaced away from the magazine to an operating position, film locating and operating elements which cooperate with a cassette in the operating position in order to effect projection of the film, a member responsive to completion of projection of the film, a cassette transfer device for displacing projected cassettes laterally of the stack to a rewinding position alongside the stack, a spool rewind-drive engageable with a spool of an already-projected cassette by displacement of the, or a second plate to a rewinding position, and a sequence control mechanism responsive to the member signifying completion of film projection and which controls the sequence and movement

of the plate or plates, the transfer device and the elements, the mechanism responding to the member by initiating a sequence of operations in which the cassettes at the projection and rewinding positions are disengaged from their respective drives by movement of the or each plate, the projected cassette is transferred laterally of the stack to replace the rewound cassette at the rewinding position and the next cassette in the magazine is introduced to the projection position, and the cassette drives are then re-engaged so that during the next film projection the film of the cassette previously projected is rewound.

Preferably the two spool drives comprise parallel shafts extending in the direction of movement of the plate or plates and which each protrude through a respective plate opening when the plate is in its operating position.

The invention will now be explained in more detail, by way of examples, with reference to the accompanying largely diagrammatic drawings, in which:—

FIGURE 1 is a cross-section through a cassette magazine mounted above a plate beneath which is positioned a sequence control cam mechanism, an optical projection system for the projector also being illustrated;

FIGURE 2 is a plan view of a two spool film cassette;

FIGURE 3 shows a cam controlled linkage for operating elements which help guide cassetted film during the projection and rewinding operations, the linkage being shown as an under-plan view;

FIGURE 4 is a side view of Figure 3 as would appear if Figure 3 was viewed from above in the drawing;

FIGURE 5 is a view corresponding to Figure 1 but shows a carrier plate which forms the floor of the magazine, in a

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raised position so that driving shafts associated with the projection and rewinding positions of the cassettes are disengaged from spools inside the cassettes;

5 FIGURE 6 is a view corresponding to Figure 5 but shows a cassette transfer device in its actuated position in full line and in its inactive position in broken outline;

10 FIGURE 7 is an under-plan view of a sequence control mechanism having a clutch responsive to movement of one of the elements shown in Figure 3;

15 FIGURE 8 is a view of the sequence control mechanism as viewed in the direction of the arrow VIII;

20 FIGURE 9 shows a modification in which used rewound cassettes are stored in a second magazine arranged alongside a magazine containing cassettes still to be projected;

FIGURE 10 shows a second modification in which the cross-sections of cassettes are shaped to enable them to slide under one another; and

25 FIGURE 11 shows a third modification in which two magazines are provided with respective separately operable carrier plates and one of the magazines for storing cassettes to be projected while the other 30 magazine is for storing cassettes which have been projected.

The cinematographic projector shown in Figure 1 comprises a support 1 bearing a reflector 2 which directs light rays, given 35 out by a lamp, from the underneath upwards, onto a mirror 3 which reflects them at right angles into the axis of an objective 4. A cassette 5, containing a film 9 to be projected (see Figure 2), has a gate 40 6 in its under surface which allows the mirror 3 to penetrate inside the cassette 5 when it is in the projection position. The mirror 3 penetrates between the take-up spool 8 and the feed spool 7 in such a way 45 that the light rays from the reflector 2 are directed onto the film 9 to be projected, and through a gate 10 in one long side 11 of the cassette 5, on the axis of the objective 4.

50 Frames of the film to be projected are moved horizontally between the take-up spool 8 and the feed spool 7 by a claw in a channel, not shown in this diagram. A shutter 12 driven by a motor 13 inter- 55 mittently interrupts the path of the light rays between the mirror 3 and the film 9 to be projected. The edge of this shutter 12 penetrates into the cassette 5 through the gate 10.

60 A magazine 14 for the cassettes 5 containing films to be projected is situated above the driving mechanism of the film 9 to be projected, the channel and the optical projection system mentioned above. 65 When a cassette 5 is in the position for

projecting, a driving shaft 15 (Figures 5 and 6) penetrates into a hub 16 (see Figure 2) of its take-up spool 8. This shaft 15 which protrudes vertically into the bottom of the magazine 14 is caused to rotate by 70 the shaft of the motor 13.

The feed spool 7 of the used cassette 5 of the film which has already been projected and is shown in Figure 5 on one side of the magazine 14, is driven by a 75 shaft 17 which protrudes into the bottom of a compartment adjacent the magazine 14. This shaft 14 is also driven by the motor 13 in order to rewind the film in the used cassette 5 onto its feed spool 7 into 80 the hub of which the shaft penetrates.

Figure 1 represents the projector with one cassette 5 in the position for projecting the film, i.e. at the lowest level in the magazine 14 and another cassette 5' in the 85 rewinding position at the lowest level in the compartment 18.

The two cassettes rest on the bottom of the magazine 14 and the compartment 18 on a plate 20 which has openings allowing 90 the vertical driving shafts 15 and 17 to pass through. When the two cassettes resting on the plate 20 have been projected and rewound respectively, a cam 21 shown in Figure 5 raises the plate 20 to disengage 95 the take-up spool and the feed spool of the first and second cassettes respectively from their driving shafts 15 and 17.

As shown in Figure 6 a second cam 22 then sets a push-lever 23 in action to trans- 100 fer the cassette 5, the film of which has been played, into the compartment 18. Simultaneously the cassette 5' whose film has been rewound onto the feed spool is 105 ejected.

As shown in Figures 3 and 4 a fourth cam 26 operates a device comprising two pairs of film tensioning rollers 24, 25 and 24' and 25', said device putting the film 9 110 into the correct position for projecting or rewinding after the cassettes have been brought to their correct position.

These cams 19, 21, 22 and 26 are all mounted on the same shaft 27 shown in Figures 7 and 8, and rotate with a clutch 115 28 which is controlled by a lever 29 bearing one tension roller 24 of the rollers associated with the film 9 to be projected. The extremity 30 of this lever 29 frees 120 another lever 31 which engages the clutch mechanism to allow rotation of the shaft 27 when the extremity 30 is moved to position 32 (see Figure 3) after projection of the film 9. This movement results from 125 the tension induced in the film by a driving claw, not shown in the diagram, when the film has been projected.

The clutch operates as follows. The shaft 27 is in one piece with a disc 33 bearing an arcuate segment 34 shown in Figure 8. 130

This segment 34 is tensioned by a spring 35 and retained in position by the end of the lever 31. On this segment there is a catch 34a which is engaged between the teeth of a ratchet-wheel 34b on the shaft 27 when the segment 34 is freed by the lever 31. The ratchet-wheel 34b is rotated by a pulley 34c and a belt 34d. Let us assume that exposure of the film is completed and the film tension, produced by the traction claw, causes the roller 24 to displace and free the lever 31 so that the pulley 34 can rotate the ratchet wheel 34b which then rotates around past the segment 34.

In the course of a 360° rotation of the shaft 27 the following events occur consecutively. A cam 19 shown in Figure 1, operates a mechanism (not shown) to close a film channel in the projection system after the projection of the film. The cam 26 releases the tension it applies to the mechanism bearing the film locating rollers 24 and 25. The cam 21 operates the mechanism which lifts the plate 20 and thus disengages the hubs of the feed spool of one cassette and the take-up spool of the other cassette from the driving shafts 15 and 17 respectively. Then the cam 22 operates the push-lever 23 which moves the cassette 5 containing the film which has just been projected from the projecting position in the magazine 14 to the rewinding position in the compartment 18 simultaneously ejecting the cassette the film 9 which has just been rewound onto its feed spool 7.

The cam 21 then causes the plate 20 to be lowered, thus causing the driving shaft 15 to enter the hub of the take-up spool 8 of a new cassette in the magazine 14, and the driving shaft 17 to enter the hub of the feed spool 7 of the cassette whose film has just been projected. The cam 26 causes the tension rollers 24 and 25 to move apart in the cassettes 5 in which are in position for projection and rewinding respectively, and cam 19 closes the film channel.

As the new film can be driven by the traction claw, the film tension on the roller 24 is less than previously and allows the lever 29 to return to the position shown in full outline in Figure 7 at which the ratchet wheel 34b is blocked and the drive to the shaft 27 is interrupted. The projection of the film 9 in the new cassette is thus able to proceed simultaneously with the rewinding of the film which has just been projected onto its feed spool 7.

In the variation shown in Figure 9 the cam 21 lifts the plate 20 initially through a distance twice the height of a cassette and then lowers the plate to the height of one cassette before the cam 22 causes the transfer of the cassette 5 whose film has just been projected into the rewinding com-

partment 18. Above this compartment is situated a second magazine 37 having spring catches near its lower edges to retain, in the second magazine the lowest cassette introduced into it. Thus there is a space under this lowest cassette into which a used cassette, may be transferred for re-winding. When the used cassette has been transferred to a position beneath the magazine 37, the plate 20 is fully lowered to allow engagement of the drive shafts 15 and 17 with the hub spool of the two cassettes.

In the variation shown in Figure 10, the long sides of the cassette 5 are at least partially inclined away from a vertical position, so that when a cassette whose film has just been projected is pushed by the push-lever 23 into the rewinding compartment 18, it pushes the cassette already there and whose film has just been rewound, upwards into the magazine 37. This saves the plate 20 having to perform a large vertical movement with two steps.

According to the variation shown in Figure 11, the projector has two plates 38 and 39 operated successively by two cams (not shown). First plate 38 lifts the cassette 5, whose film has been rewound, into the magazine 37 where it is retained by spring catches 36. Then after it has returned to its original lower level it receives the cassette 5 whose film has just been projected, and which is transferred from the projection compartment by the push-lever 23.

Other modifications are of course possible. The plate 20, instead of being flat, can also be made in two levels, for example, the higher level corresponding with that of the cassette whose film is to be rewound and being connected by a sloping surface to the lower level which corresponds with that of the cassette whose film is to be projected. After projecting a film, the corresponding cassette is pushed up the slope to the higher level of the plate 20 and causes the cassette whose film has been rewound to be pushed into the magazine 37. The cassette just used is then in a position at which it can be rewound when the plate 20 is lowered.

WHAT WE CLAIM IS:—

1. A cinematographic projector having a magazine for accommodating a stack of film cassettes to be consecutively projected, a plate bodily displaceable towards and away from one end of the magazine from which the cassettes are selected consecutively for projection, a take-up spool drive arranged to cooperate with a cassette to be projected when the plate is displaced away from the magazine to an operating position, film locating and operating elements which cooperate with a cassette in the operating position in order to effect

This segment 34 is tensioned by a spring 35 and retained in position by the end of the lever 31. On this segment there is a catch 34a which is engaged between the 5 teeth of a ratchet-wheel 34b on the shaft 27 when the segment 34 is freed by the lever 31. The ratchet-wheel 34b is rotated by a pulley 34c and a belt 34d. Let us assume that exposure of the film is completed and 10 the film tension, produced by the traction claw, causes the roller 24 to displace and free the lever 31 so that the pulley 34 can rotate the ratchet wheel 34b which then rotates around past the segment 34.

15 In the course of a 360° rotation of the shaft 27 the following events occur consecutively. A cam 19 shown in Figure 1, operates a mechanism (not shown) to close a film channel in the projection system 20 after the projection of the film. The cam 26 releases the tension it applies to the mechanism bearing the film locating rollers 24 and 25. The cam 21 operates the mechanism which lifts the plate 20 and 25 thus disengages the hubs of the feed spool of one cassette and the take-up spool of the other cassette from the driving shafts 15 and 17 respectively. Then the cam 22 30 operates the push-lever 23 which moves the cassette 5 containing the film which has just been projected from the projecting position in the magazine 14 to the rewinding position in the compartment 18 simultaneously ejecting the cassette the 35 film 9 which has just been rewound onto its feed spool 7.

The cam 21 then causes the plate 20 to be lowered, thus causing the driving shaft 15 to enter the hub of the take-up spool 8 40 of a new cassette in the magazine 14, and the driving shaft 17 to enter the hub of the feed spool 7 of the cassette whose film has just been projected. The cam 26 causes the tension rollers 24 and 25 to move apart in 45 the cassettes 5 in which are in position for projection and rewinding respectively, and cam 19 closes the film channel.

As the new film can be driven by the traction claw, the film tension on the roller 50 24 is less than previously and allows the lever 29 to return to the position shown in full outline in Figure 7 at which the ratchet wheel 34b is blocked and the drive to the shaft 27 is interrupted. The projection of the film 9 in the new cassette is 55 thus able to proceed simultaneously with the rewinding of the film which has just been projected onto its feed spool 7.

In the variation shown in Figure 9 the 60 cam 21 lifts the plate 20 initially through a distance twice the height of a cassette and then lowers the plate to the height of one cassette before the cam 22 causes the transfer of the cassette 5 whose film has 65 just been projected into the rewinding com-

partment 18. Above this compartment is situated a second magazine 37 having spring catches near its lower edges to retain, in the second magazine the lowest 70 cassette introduced into it. Thus there is a space under this lowest cassette into which a used cassette, may be transferred for rewinding. When the used cassette has been transferred to a position beneath the 75 magazine 37, the plate 20 is fully lowered to allow engagement of the drive shafts 15 and 17 with the hub spool of the two cassettes.

In the variation shown in Figure 10, the long sides of the cassette 5 are at least 80 partially inclined away from a vertical position, so that when a cassette whose film has just been projected is pushed by the push-lever 23 into the rewinding compartment 18, it pushes the cassette already 85 there and whose film has just been rewound, upwards into the magazine 37. This saves the plate 20 having to perform a large vertical movement with two steps.

According to the variation shown in 90 Figure 11, the projector has two plates 38 and 39 operated successively by two cams (not shown). First plate 38 lifts the cassette 5, whose film has been rewound, into the magazine 37 where it is retained by spring 95 catches 36. Then after it has returned to its original lower level it receives the cassette 5 whose film has just been projected, and which is transferred from the projection compartment by the push-lever 23. 100

Other modifications are of course possible. The plate 20, instead of being flat, can also be made in two levels, for example, the higher level corresponding with 105 that of the cassette whose film is to be rewound and being connected by a sloping surface to the lower level which corresponds with that of the cassette whose film is to be projected. After projecting a film, the corresponding cassette is pushed up the 110 slope to the higher level of the plate 20 and causes the cassette whose film has been rewound to be pushed into the magazine 37. The cassette just used is then in a position at which it can be rewound 115 when the plate 20 is lowered.

WHAT WE CLAIM IS:—

1. A cinematographic projector having a magazine for accommodating a stack of film cassettes to be consecutively projected, 120 a plate bodily displaceable towards and away from one end of the magazine from which the cassettes are selected consecutively for projection, a take-up spool drive arranged to cooperate with a cassette 125 to be projected when the plate is displaced away from the magazine to an operating position, film locating and operating elements which cooperate with a cassette in the operating position in order to effect 130



projection of the film, a member responsive to completion of projection of the film, a cassette transfer device for displacing projected cassettes laterally of the stack to a rewinding position alongside the stack, a spool rewind-drive engageable with a spool of an already-projected cassette by displacement of the, or a second plate to a rewinding position, and a sequence control mechanism responsive to the member signifying completion of film projection and which controls the sequence and movement of the plate or plates, the transfer device and the elements, the mechanism responding to the member by initiating a sequence of operations in which the cassettes at the projection and rewinding positions are disengaged from their respective drives by movement of the or each plate, the projected cassette is transferred laterally of the stack to replace the rewind cassette at the rewinding position and the next cassette in the magazine is introduced to the projection position, and the cassette drives are then re-engaged so that during the next film projection the film of the cassette previously projected is rewound.

2. A projector as claimed in claim 1, in which the two spool drives comprise parallel shafts extending in the direction of movement of the plate or plates and which each protrude through a respective plate opening when the plate is in its operating position.

3. A projector as claimed in claim 1 or claim 2, in which the magazine holds a vertical stack of cassettes which rest on the or one of the plates, and the sequence control mechanism includes a cam which produces the displacement of the or one of the plates.

4. A projector as claimed in any one of the preceding claims, having two plates which are separately displaceable and which are coplanar when the plate associated with the magazine is in its operating position and the other plate is in the cassette rewinding position, the displacement of both plates being controlled by cam and the two plates moving separately from one another.

5. A projector as claimed in any one of

the preceding claims, in which the cassette transfer device comprises a push member controlled by a lever operated by a cam turned by the sequence control mechanism.

6. A projector as claimed in any one of the preceding claims, in which the film locating and operating elements include rollers positionally controlled by a cam turned by the sequence control mechanism, the rollers operating by moving apart to guide the film being projected and also the film being rewound.

7. A projector as claimed in claim 6, in which the tension of one of the rollers providing a guide for the film being projected, is used to operate the member which responds to completion of film projection.

8. A projector as claimed in any one of the preceding claims, in which a cam controlled by the sequence control mechanism determines whether a film guiding channel associated with an optical projection system is opened or closed.

9. A projector as claimed in any one of the preceding claims, in which the sequence control mechanism includes a cam shaft rotated by a drive transmitted through a clutch which is engaged when the member senses completion of film projection.

10. A projector as claimed in claim 9, in which the clutch operates to allow the cam shaft to be rotated through one revolution only in response to each detection by the member of completion of film projection.

11. A projector as claimed in any one of the preceding claims, in which the member responds to the tension of the film being projected between the position of a film gate and a film traction claw drawing the film step-by-step through the film gate.

12. A projector as claimed in claim 1, arranged and adapted to operate substantially as described with reference to Figures 1 to 8 of the accompanying drawings.

13. A projector as claimed in claim 12, modified substantially as described with reference to any one of Figures 9 to 11 of the accompanying drawings.

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