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(54) A DEVICE FOR USE ON A FILM PROJECTOR FOR COPYING FILMS

(71) We, BRAUN AKTIENGESELLSCHAFT, a German Body Corporate, of 22 Rüsselsheimer Strasse, D-6000 Frankfurt-am-Main, 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:—

This invention relates to a device for use on a film projector for copying films by means of a cine camera equipped with a single-frame release means.

The term "single-frame release means" of a cine camera is used hereinafter to refer to means for causing such cine camera to expose a single-frame of film and to advance the film by a single-frame. Repeated operation of the single-frame release means thus causes successive frames to be exposed.

A number of devices for copying cinematographic films are already known which generally comprise a projection unit and a photographic unit, which are assembled at the correct distance apart for projection purposes. Such devices include a photographic chamber, which can be sealed against the entry of light, in which one inserts the copy film, on which the individual frames of the original film to be copied are projected. Copying devices of such a type have to be specially designed and can only be used for this specific purpose.

An object of the invention is to provide a device for use on a cine film projector of the usual type of construction so that it can be used together with a cine camera equipped with a single-frame release means as hereinbefore defined.

The device includes a speed-changing mechanism for changing the speed of projection to less than 8 frames per second, a pulse-generating switch, which is adapted to operate once for each frame advance of the film feed of the film projector, and means for transmitting a generated pulse to the cine camera to operate the single-frame release means thereof, as hereinbefore defined. With such a device it is possible to copy films by projecting a picture on to a screen to which the cine camera is directed. The speed of projection must be chosen slightly lower than the fastest possible frame sequence time of the cine camera in the single-frame mode of operation.

The speed-changing mechanism disconnects the pulse-generating switch from the transmitting means at normal projection speeds, which are usually within the range of from 16 to 25 frames per second. This prevents copying by error at too high a frame speed at which, because of the inertia of the single-frame release means of the camera, correct copies cannot be made. The speed changing mechanism is preferably such as to reduce the speed of projection to about 5 frames per second. This projection speed is somewhat lower than the maximum photographing speed during single-frame operation of a cine camera. The speed of projection can be varied for adaptation to the speed of the cine camera.

Having regard to the fact that, with many types of cine camera, a different period of time elapses between operation of the single frame release means and exposure, the moment of operating the pulse-generating switch may be adjustable to relate to the film feed of the film projector. The pulse-generating switch may be a contact maker which is controlled by a cam mounted on the same shaft as the revolving shutter of the film projector. The position of the contact maker can be adjustable.

An auxiliary switch, controllable by markings on the film to be copied, may be provided for switching the transmitting means on and off. This enables only specific scenes or sections of a film to be copied.

The invention will now be described by way of example with reference to the accompanying drawings. In the drawings:—

Figure 1 is a schematic view of a film projector equipped with a device according to the invention, and

Figures 2a, 2b, 2c and 2d are graphical representations of the operations of various parts of a film projector having a device according to the invention as a function of time.

Figure 1 shows those parts of a film projector which are necessary for understanding the device according to the invention. The film projector includes a shaft 1 on which is secured a pulley 2 which is connected to a small diameter pulley 6, fitted on the output shaft 4 of an electric motor 5, by a rubber belt 3. Shaft 1 also carries a three-bladed shutter 7 which moves in front of a film channel 8, through which a film can be moved in the usual way by a claw mechanism (not shown). Shaft 1 further carries a cam disc 9, which is provided with a lobe 10, in the path of which lie two interacting contact elements 11 and 12 of a contact maker 13. Shaft 1 is coupled to the driving mechanism for the film F such that the bladed shutter 7 makes one revolution per frame feed. The contact maker 13 is attached to a slidable retaining part 14 the position of which can be adjusted by means of a protrusion 15 by sliding said part 14 in either direction of the double arrow to adjust the precise moment of operation of the contact maker. Retaining part 14 has a slot 16 which receives two retaining screws 17 spaced from one another by a distance less than the length of slot 16. An auxiliary switch 18 which lies adjacent one edge of the film F has contacts which are closed on each occasion when a notch in the film passes the switch. The notches mark the beginning and end of each length of film to be copied.

A speed-changing mechanism 19 is also provided by means of which the speed of projection of the film projector can be converted either to a usual value of about 18 frames per second or to a lower value of about 5 frames per second. At a reduced speed of projection, the speed-changing mechanism opens contacts which normally bridge a resistor 20 in the supply line of the electric motor 5 and, at the same time, interconnects contacts 21 and 22 which are in series with contact spring 11. A switching mechanism 23, consisting of a bi-stable flip-flop 24 and an operating relay 25 connected to an output of the flip-flop 24, is in series with the other contact spring 12. The input 26 of the bi-stable flip-flop 24 is connected through auxiliary switch 18 to a supply lead for the electric motor 5 so that the flip-flop 24 changes state on each occasion when a notch in the film is passed.

The device operates in the following manner. During normal operation of the film projector, i.e. when showing a film, the speed-changing mechanism 19 is in the position illustrated in Figure 1 in which resistor 20 is short-circuited and the full supply voltage is fed to the electric motor 5. Contacts 21 and 22 are then opened, so that pulses generated by the contact making of contact maker 13 are not transmitted to a two-strand cable 27 leading to the cine camera's single-frame release means. At this normal speed of projection, therefore, the cine camera is not actuated and thus, if an attempt is made to copy a film with this high frame speed, no film is wasted in the filming camera.

For copying a film, the speed-changing mechanism 19 is switched over, i.e. it is moved to the left as viewed in Figure 1. The resistor 20 is, therefore, connected in the supply line of the electric motor 5 and the latter turns at a reduced speed, which should correspond to a frame speed of the film projector of between 4 and 6 frames per second. This frame speed is low enough to permit photographing the projected frames with single-frame operation of the movie camera whilst, on the other hand, it is high enough to prevent burning of the film if the heat-absorbing filter has not been switched on. Contacts 21 and 22 of the speed-changing mechanism are closed, so that pulses generated as a result of contact making of contact maker 13 are transmitted to the connecting cable 27 for as long as the operating relay 25 is closed as determined by the notches in the film and the auxiliary switch 18.

Contact maker 13 is so arranged with respect to the lobe 10 of the cam that the exposure time of a single frame of the cine camera falls within the projection time of a frame of the film to be copied. The various time relationships will be discussed in detail with reference to the graphical representations of Figure 2. Figure 2a shows the film speed V_F with respect to the time at the film projector and Figure 2b shows the luminous flux L of the film projector. Exposure of the frame visually occurs, as is evident from comparison with Figure 2a, after completion of the film feed.

Figure 2c shows the speed U of the driving motor of the camera relative to the time from commencement of the release of the single frame release means until the camera stops at the end of a single-frame operation and Figure 2d shows the exposure of the film in the single-frame mode of operation. The moment of release of the shutter of the movie camera in relation to the commencement of exposure

at the film projector (Figure 2b) is so delayed that the exposure of the copy film lies within the period of exposure of the film projector. Since various types of cine cameras have different time lags between operation of the single-frame release means and the commencement of exposure, an adjustment may be made by means of the protrusion 15, so that during single-frame operation of the cine camera exposure always takes place at an optimum phase relationship to the film feed of the projector.

A device according to the invention can be used both in film projectors with a single-blade shutter and in those with a multi-blade shutter and the exposure need not be restricted to one gap of the shutter. The insertion of a heat-absorbing filter is optional.

Means may be provided for making the reduced speed of projection adjustable.

WHAT WE CLAIM IS:—

1. A device for use on a cine film projector for copying cine films by means of a cine camera equipped with a single-frame release means, said device including a speed-changing mechanism for changing the speed of projection to less than 8 frames per second, a pulse-generating switch which is adapted to operate once for each frame advance of the film feed of the film projector, and means for transmitting a generated pulse to the cine camera to operate the single-frame release means thereof, as hereinbefore defined.

2. A device according to claim 1, wherein the speed-changing mechanism includes a cut-out switch which disconnects the pulse-generating switch from the transmitting means at projection speeds in excess of 8 frames per second.

3. A device according to claim 1 or claim 2, wherein the speed changing mechanism is operable to reduce the speed of projection to within the range 4 to 6 frames per second.

4. A device according to claim 3, wherein the reduced speed of projection is adjustable.

5. A device according to any preceding claim, wherein means are provided for adjusting the moment of operating the pulse-generating switch relative to the film feed of the film projector.

6. A device according to any one of the preceding claims, wherein the pulse-generating switch is a contact maker which is controlled by a cam mounted on the same shaft as the revolving shutter of the film projector.

7. A device according to claim 6, wherein the operating position of the contact maker can be adjusted.

8. A device according to any one of the preceding claims which includes an auxiliary switch controllable by markings on the film to be copied, for switching the transmitting means on and off.

9. A device for use on a film projector substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

10. A film projector including a device according to any preceding claim.

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2. A device according to claim 1, wherein the speed-changing mechanism includes a cut-out switch which disconnects the pulse-generating switch from the transmitting means at projection speeds in excess of 8 frames per second.

3. A device according to claim 1 or claim 2, wherein the speed changing mechanism is operable to reduce the speed of projection to within the range 4 to 6 frames per second.

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5. A device according to any preceding claim, wherein means are provided for adjusting the moment of operating the pulse-generating switch relative to the film feed of the film projector.

6. A device according to any one of the preceding claims, wherein the pulse-generating switch is a contact maker which is controlled by a cam mounted on the same shaft as the revolving shutter of the film projector.

7. A device according to claim 6, wherein the operating position of the contact maker can be adjusted.

8. A device according to any one of the preceding claims which includes an auxiliary switch controllable by markings on the film to be copied, for switching the transmitting means on and off.

9. A device for use on a film projector substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

10. A film projector including a device according to any preceding claim.

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