NEW MOTION PICTURE APPARATUS

During the Conventions of the Society, symposiums on new motion picture apparatus are held, in which various manufacturers of equipment describe and demonstrate their new products and developments. Some of this equipment is described in the following pages; the remainder will be published in subsequent issues of the Journal.

A FLEXIBLE TIME-LAPSE OUTFIT*

A. B. FULLER AND W. W. EATON**

Motion pictures which have been produced by exposing single frames at regularly spaced intervals and then projecting the film in the ordinary way constitute a valuable method of studying growths or movements which take place at a relatively slow rate. By way of contrast to our familiar slow-motion pictures, such movies may be called "fast-motion" pictures because they apparently speed up the action and cause it to appear to take place faster than it actually did. These "time-lapse" pictures find their most frequent application in the study of growing plants or cells and similar subjects; for the growth or movement which required weeks or months may be condensed to a few moments on the screen and is available for repetition and study.

The essentials for time-lapse photography are a motion picture camera that can be actuated one frame at a time and an automatic method of actuating such a camera at intervals which are adjustable to suit the rate of growth or motion being studied. As far as the camera is concerned, the Cine-Kodak Special is well suited for this type of work, and the apparatus to be described has been built to be used in conjunction with it. An automatic method of actuating the camera at desired intervals is a necessity, since in most cases it would be entirely impracticable for an operator to do this. The purpose of this paper is to describe briefly an apparatus which has been designed by the Eastman Kodak Company to meet such a need. The principal requirements for such an outfit are flexibility and convenience.

In some cases it may be desirable to make pictures a few seconds or a fraction of a second apart, because the movement being studied is relatively fast. In other circumstances, the interval between successive pictures may have to be minutes or even many hours in order to produce the desired amount of action on the screen in a reasonable length of time when the film is finally projected as

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a motion picture. In addition, such an outfit should be convenient to use and should be easily portable. Finally, since so many subjects will require artificial illumination, it is important to have an automatic method of turning the lights on for the exposure and turning them off afterward, no matter what the interval between pictures may be. The equipment which has been constructed to meet the above requirements is known as the Electric Time Lapse Outfit. It consists

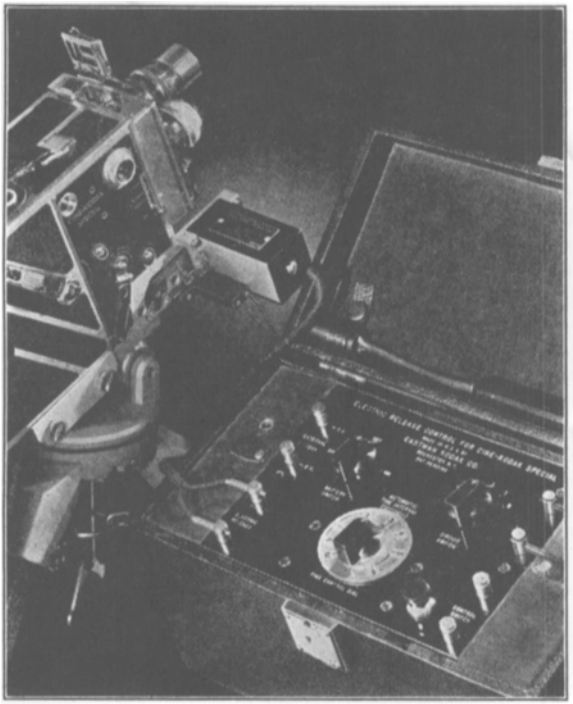

FIG. 1. The Electric Release Control for the Cine-Kodak Special, consisting of the Electric Release, which is mounted on the camera, and the Electric Release Control box, which supplies the necessary impulses to control the camera action.

of two parts, the Electric Release Control and the Interval Timer, which will be described separately.

The Electric Release Control.—The Electric Release Control is shown in Fig. 1. It consists of the Electric Release, which attaches to the Cine-Kodak Special, and the Electric Release Control box. The Electric Release contains an electromagnet, to which electrical energy is supplied by the Electric Release Control box. It is mounted on the camera, as shown in the illustration, in such a way that when energized momentarily the electromagnet pulls an armature away

from a butterfly cam placed on the one-frame shaft of the camera and allows the shaft to rotate either a half or a full turn under the camera's own power, according to the position of a control lever. A half-rotation of the shaft changes the camera shutter from closed to open, or the reverse. This action, which corresponds to that of an ordinary "still" camera shutter when set on *Time*, permits time exposures to be made. In another position of the control lever the shaft is allowed to make a complete revolution for each impulse supplied from the Electric Release Control box. This results in instantaneous exposures.

The Electric Release Control box houses the electrical equipment needed for the control of the electromagnet in the Electric Release. By means of proper settings it is possible to supply momentary impulses to the Electric Release in a variety of ways. Either instantaneous, time, or bulb exposures can be made manually by the operator, or instantaneous exposures can be made automatically at intervals of from 1/4 to 6 seconds, through the use of a condenser-resistance timing circuit. Also, it is possible for either the operator or some external timing device to initiate single, automatically timed exposures which may be set throughout a range of 1/4 to 6 seconds. And, finally, a remote control of the ordinary camera action is provided by allowing the electromagnet to be energized continuously so that the camera is free to run in the normal way.

Although power is normally supplied from four self-contained flashlight cells, provision is made on the panel for connecting an external 6-volt battery for long, unbroken runs. Also, a hand-control switch is provided which can be used in place of the control button on the panel, thus allowing the operator considerable freedom of movement while still retaining control of the camera.

The Electric Release Control thus presents in itself complete manual and limited automatic control of the Cine-Kodak Special in applications where individual film frames are exposed at intervals or where remote control of the ordinary camera action is desired. It is especially intended for animation work, growth studies, and similar projects. Although it will automatically take instantaneous pictures spaced no more than six seconds apart, these intervals are quite satisfactory for many types of growth or other work. When used in conjunction with a timer and lamp control, such as will be described below, its range and usefulness are extended so that it will cover almost any conceivable application.

The Interval Timer.—The Interval Timer is an instrument which has been designed primarily for use in conjunction with the Electric Release Control and the Cine-Kodak Special. Its functions are to actuate the Electric Release Control at intervals, and thus cause either instantaneous or time exposures to be made and, in addition, to provide means for turning on and off the lights required in many cases. Like the Electric Release Control, the Interval Timer has self-contained flashlight cells, but facilities are provided for the use of an external battery when needed. As in the Electric Release Control, the basic timing circuit is achieved by means of a condenser being charged through a resistance. In the Interval Timer the timing circuit provides regularly spaced impulses according to its setting, which come either 1/4 second or 1/4 minute apart. Through the use of a fixed multiplier which introduces a factor of 60, a basic interval of 1/4 hour is also possible. The fundamental idea of the instrument is to multiply one of these basic times by a predetermined factor in order to achieve a different longer interval. The impulses are used in a variable multi-

plier to index a ratchet wheel forward, one tooth at a time, by means of an actuating relay. After a certain number of impulses, a contact on the wheel strikes an adjustable contact which causes the wheel to reset automatically to its zero position. This action of resetting determines the completion of the interval or cycle. It turns on the lamps and subsequently starts the exposure *via* the Electric Release Control, or in case the lamp control is not being used, initiates the exposure directly. The number of impulses necessary for resetting is deter-

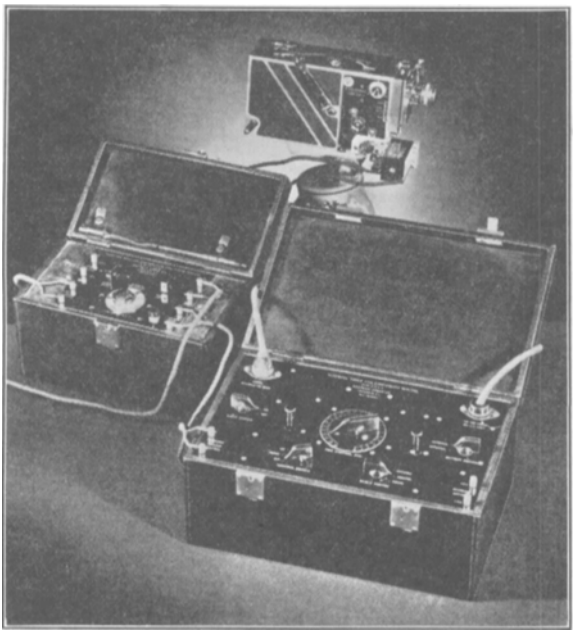

FIG. 2. The complete Electric Time Lapse Outfit, shown with the Cine-Kodak Special. The Interval Timer is in the foreground, the Electric Release Control box is at the left, and the Electric Release is mounted on the camera.

mined by means of a dial knob on the panel, and may be set from 1 to 96. This setting, together with the selection by another knob of the basic time which is to be used, determines the interval for which the machine is set. At the end of every such interval the machine will reset automatically, initiate an exposure through the Electric Release Control, and proceed to time the next interval. The scales are so arranged that the instrument may be set to initiate exposures at intervals from $^1/_4$ second to 24 seconds in $^1/_4$-second steps, from $^1/_4$ minute to 24 minutes in $^1/_4$-minute steps, and from $^1/_4$ hour to 24 hours in $^1/_4$-hour steps.

For almost all time-lapse work which extends longer than a few hours, it is desirable to have the subject illuminated by artificial light so that the exposure

and general lighting may be kept uniform. For pictures spaced farther apart than about half a minute or so, it is equally undesirable to have the lamps burning continuously, particularly if they are of the Photoflood type and considerable light is required. For this reason it was decided to incorporate into the Interval Timer an automatic lamp control so that the lamps would be turned on before the exposure is made, and turned off afterward, regardless of the interval between pictures. This is accomplished by providing a small synchronous line-voltage motor which controls the lamp circuit. When the end of the cycle is reached and the wheel resets, the lamps are turned on, and shortly thereafter the Electric Release Control is activated, thus causing the exposure to take place. Eight seconds after the lights go on they are automatically cut off, regardless of the duration of exposure. This is to cover the longest time exposure possible—namely, 6 seconds. In case pictures are being made at intervals of a few seconds, the lamp control circuit is not used and the lights are simply plugged directly into the line. Under such conditions, or where the lamp control is not desired, the motor is not used, and therefore no power line to the Interval Timer is necessary.

The Complete Time-Lapse Outfit.—Although the Electric Release Control may be used alone with the Cine-Kodak Special in many instances, it is the addition of the Interval Timer to form the complete Electric Time-Lapse Outfit which provides the most convenient way of meeting almost any growth study or similar problem. The complete outfit is illustrated, with the Special, in Fig. 2. Operation is simple and there are relatively few steps involved in setting up the equipment to make a time-lapse film. The Electric Release, together with the cam which governs the action of the one-frame shaft, must be mounted on the camera and proper connections made to the Electric Release Control box, and from it to the Interval Timer. In case lamps are to be used, they are plugged into an outlet on the Interval Timer panel, and the power line which furnishes the lamp current is connected to a corresponding receptacle. Assuming the necessary camera and lighting adjustments to be made, the actual exposure time desired is set by means of knobs on the Electric Release Control box panel. This may be either instantaneous, varying with camera settings from $^1/_{100}$ second to $^1/_{20}$ second, or a time exposure which may be set throughout a range of $^1/_4$ second to 6 seconds. The interval desired between the beginning of successive exposures is set by means of the two control knobs on the Interval Timer panel, as explained previously. It is important to note that the exposure settings and the interval time settings are entirely independent. All that remains is to turn a control switch, and the complete outfit will function without any attention whatsoever, as long as the spring motor in the camera is not run down. During the progress of the run any necessary changes in the adjustments to compensate for changes in growth rate or lighting may be easily made without interrupting the action of the outfit. Inasmuch as both units have self-contained batteries, the outfit is easily portable. Unless power for the lamps is wanted, a power line is not necessary.

The complete outfit as described thus provides all the equipment (not including camera) necessary for making time-lapse films. Although a great many uses of such an outfit lie in the field of growth study work, it has, of course, applications in many other fields as well. For example, in recording the progress of a con-

struction project, in recording the readings of meters or controls at desired intervals, in traffic-control study, and in fact, in any application where the motion or growth occurs at such a rate that it is convenient to condense it for the purposes of study, such equipment should be extremely useful.

DISCUSSION

MR. FLORY: What load will the interval-timer accommodate on the lamp circuit?

MR. EATON: It is rated at 10 amperes, 115 volts.

MR. FLORY: Can you use an external source of power, such as a 6-volt battery?

MR. EATON: Either of these boxes can be used either with its own self-contained batteries, or with an external battery. The same 6-volt battery will function for both of the units.

MR. BRADY: Could the outfit be used for submarine work; say, in a diving bell?

MR. EATON: Certainly. The only limitation is the fact that the camera spring motor will run down after a certain length of time, depending upon the interval between the pictures. The camera has a long run—about 40 feet of 16-mm film—but if pictures are taken every second or thereabouts, the film will be used up very rapidly. On the other hand, if the interval is longer—say, one picture an hour—the camera will operate for a long time without attention.

MR. HOLSLAG: Does the apparatus permit the use of a motor drive?

MR. EATON: There is a motor drive, of course, as an accessory for the Cine-Kodak Special, but it would have to be adapted to be used with this time-lapse outfit. If you had a special problem that you wanted to work out, it could be done, using the outfit as a basis.

FILM SPLICER FOR DEVELOPING MACHINES*

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The splicer to be described was developed for use on high-speed, sprocketless, 35-mm developing machines. Above all else, such a splice must be dependable; that is, it must not catch on guards or blow-offs, and must not pull apart in spite of passing around hundreds of small pulleys. Metallic fastening devices localize the stresses which are apt to start tears. By using a special adhesive tape to make the splice, the stress is distributed over the full width of the film. To prevent the tape from being soaked loose in the developing solutions, its "linen" base is waterproofed, and a hole is punched through the center of the film at each edge of the tape. The tape thus sticks to itself through these holes, preventing the edge of the tape from lifting when the emulsion swells. The ends

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