April 25, 1933. K. SCHNEIDER 1,905,511

AUTOMATIC LIGHT CONTROL

Filed Sept. 24, 1931 4 Sheets-Sheet 1

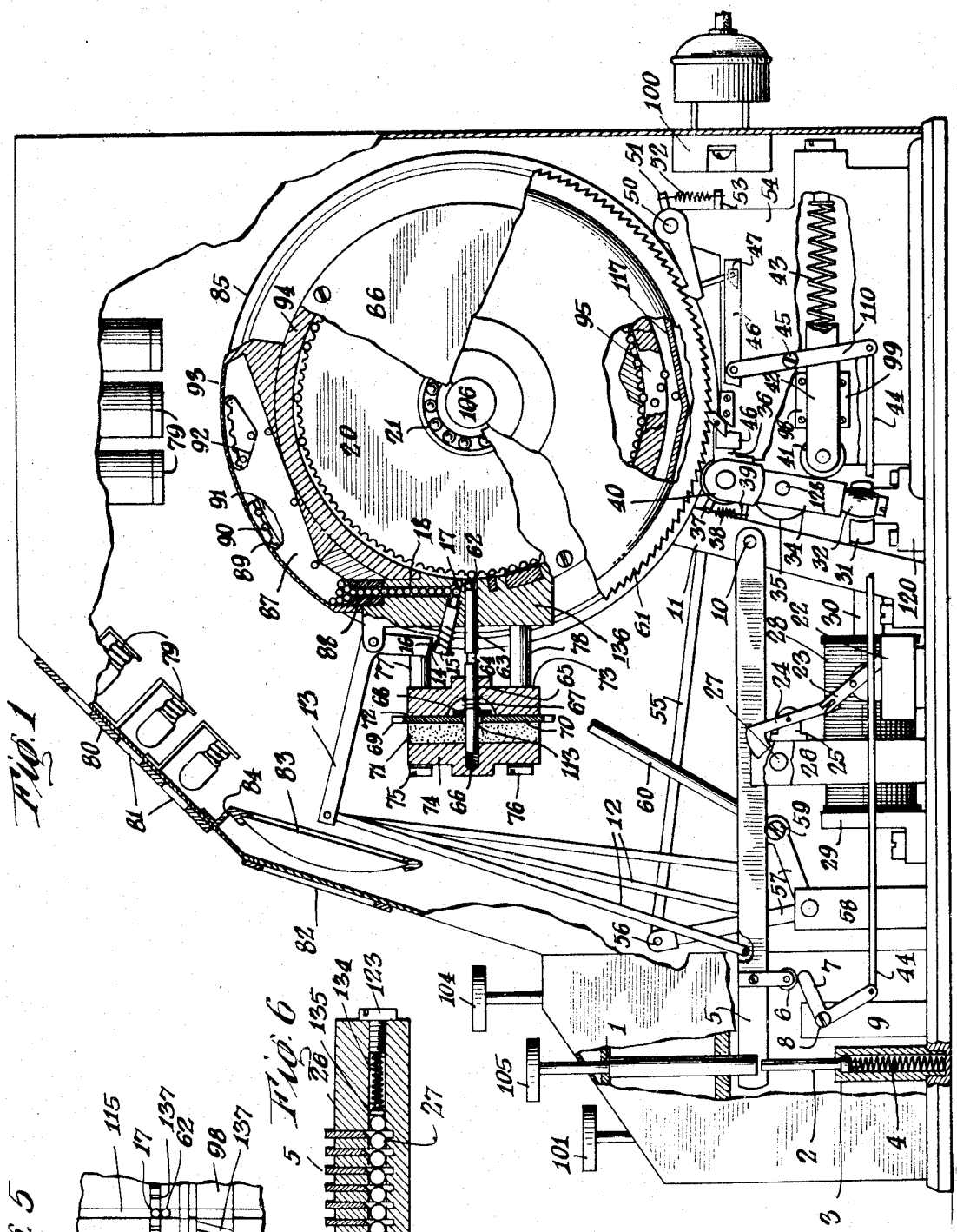


Fig. 1

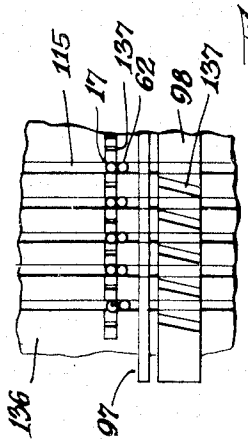


Fig. 5

Fig. 6

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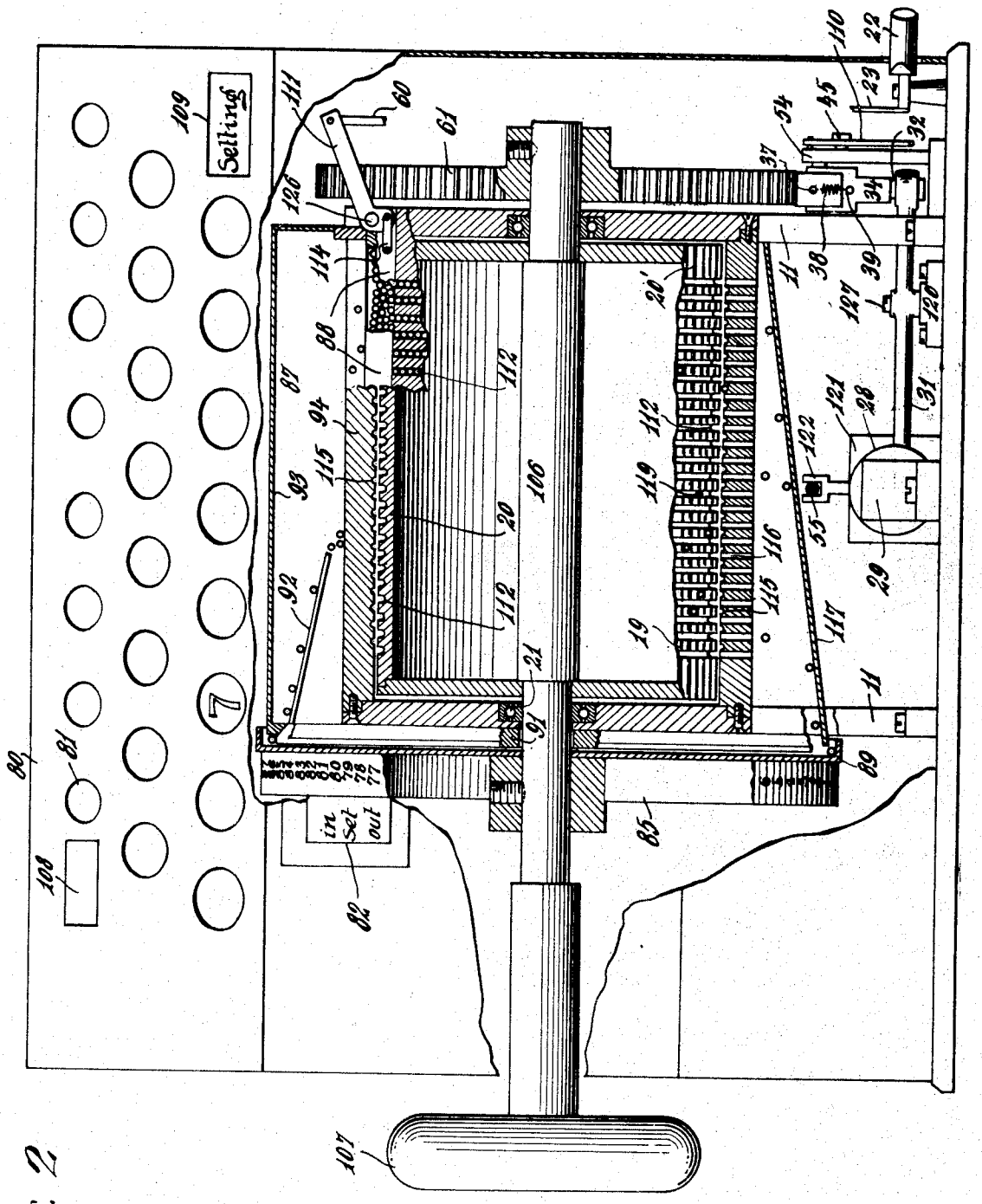


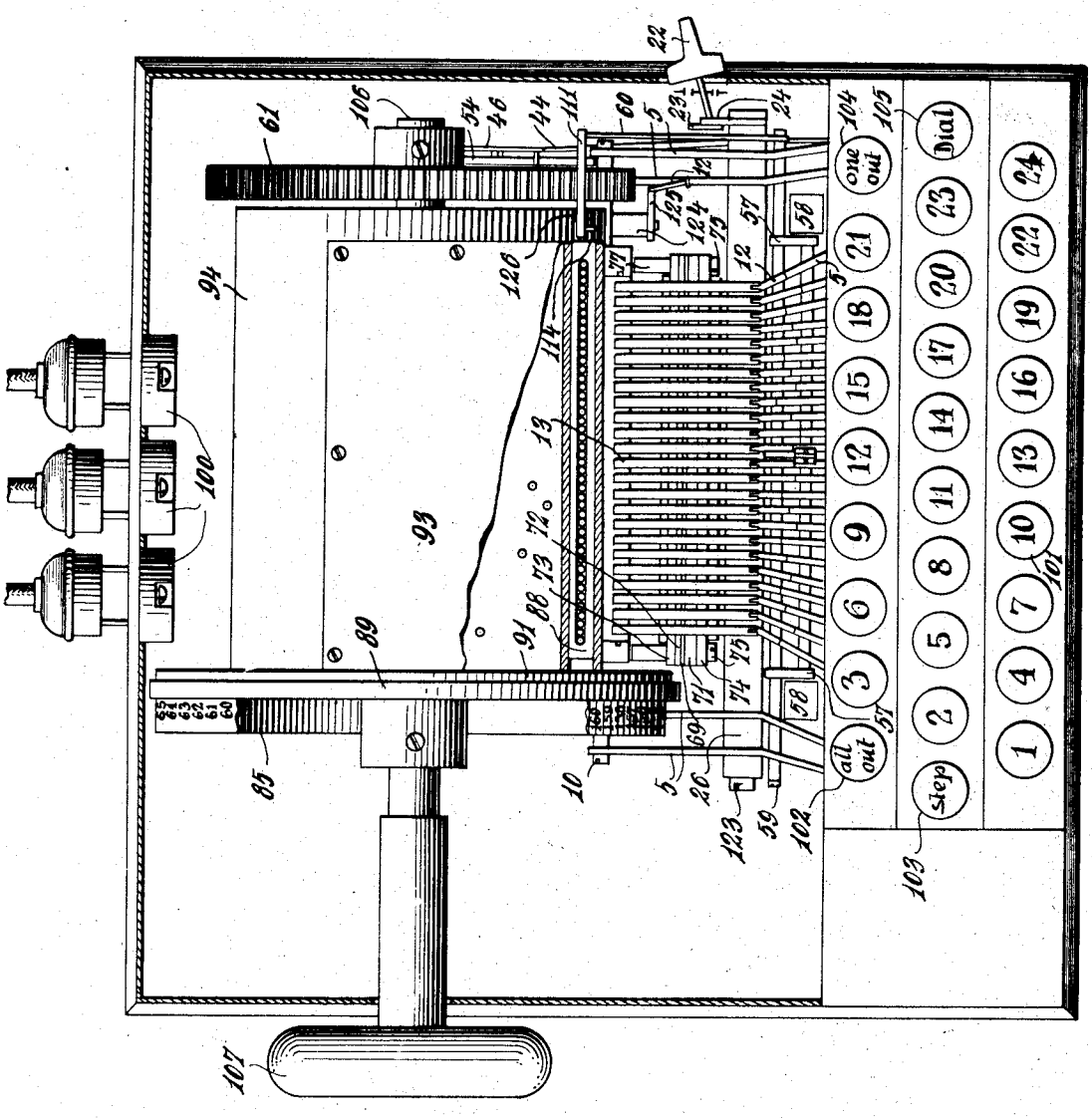
Fig. 2.

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AUTOMATIC LIGHT CONTROL

Filed Sept. 24, 1931 4 Sheets-Sheet 4

Fig. 4

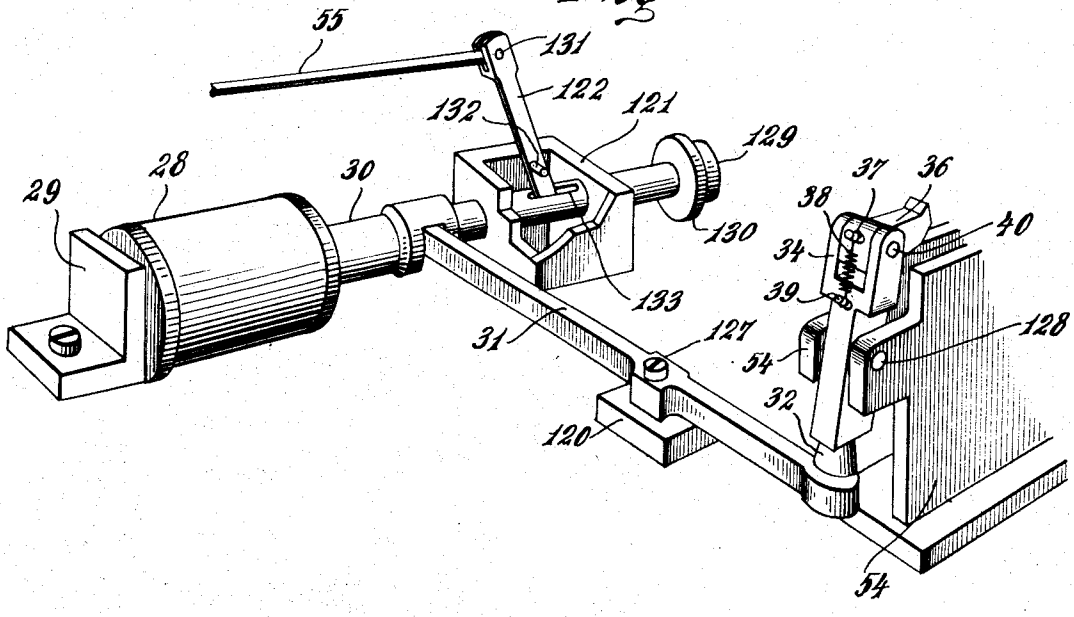
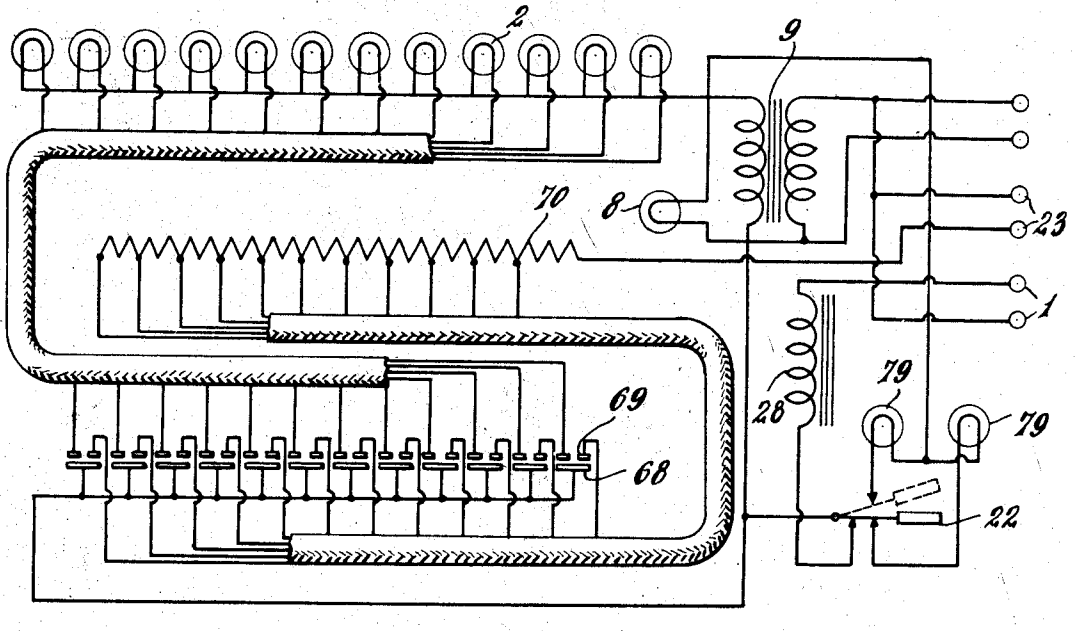


Fig. 7



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UNITED STATES PATENT OFFICE

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AUTOMATIC LIGHT CONTROL

Application filed September 24, 1931. Serial No. 564,791.

This invention relates to improvements in automatic light controls, and particularly to the automatic control of exposed lamps, such as are used in motion picture film printing machines.

One of the principal objects of the invention is to provide means to properly expose each scene of a motion picture positive film. This is accomplished in the following simple and efficient manner: The device is set by means of a keyboard so that a correct intensity of light is registered for each scene. After the device is set it may be checked by comparing the registered light intensities with those given by the "printing card," a record made when the negative was timed. After being set the device is ready to operate in conjunction with the "breaker box" of the printing machine. During the operation of the printing machine, the intensity of the printing light is automatically controlled by the device, so that any number of prints may be obtained from a given negative with the same sequence of light changes. A simple method is provided to enable the changing of the exposure intensity for any one or more scenes, if it is desirable to do so. A clearing means is also provided to cut all exposure values out of register, thus enabling the machine to be reset.

Another object of the invention is to provide means to control a number of electrical circuits so that they will operate individually in a predetermined order. Other applications of the invention are the setting and control of advertising signs, novelty displays, and other electrical apparatus employing a multiple contact system.

An automatic light control, which embodies the principles of the invention, is shown in the accompanying drawings.

In appearance the machine somewhat resembles a typewriter being about the same size and having a similar keyboard. It also has an indicating panel which registers a sequence of light changes for any number up to 160 scenes and shows whether the machine is set for timing or for printing. Beneath the indicating panel is a small window through which may be viewed a drum dial which is read against a fixed scale. The dial is graduated from 1 to 160 and the scale is blocked out into three sections, "in," "set," and "out." To the right of the window is mounted a shielded lamp which illuminates the keyboard consisting of 28 keys, 24 of which are numbered from 1 to 24, the other four being marked "All out," "Step," "One out," and "Dial." A special feature of the keyboard is that only one key can be operated at a time when setting the machine and when the switch on the right side of the machine is changed from the setting to the printing position, all keys are automatically locked.

In the drawings which accompany this disclosure:

Fig. 1 shows a partial plan and sectional side view.

Fig. 2 shows a partial plan and sectional front view.

Fig. 3 shows a top view, partly sectioned and with top removed.

Fig. 4 shows a detail view of the ratchet operating mechanism.

Fig. 5 represents a detail view of the clearing mechanism.

Fig. 6 shows a detail view of the key locking mechanism.

Fig. 7 shows a wiring diagram.

Before describing the construction of the machine it may be analyzed as consisting of the following essential elements.

I.—A drum driven by a ratchet movement and adapted to carry balls.

II.—A keyboard and lever mechanism.

III.—A contact mechanism.

The drum 20, shown in Figures 1, 2, and 3, has milled upon its surface 160 laterally

milled, concave grooves 20′ which are transversely cut by twenty-four longitudinal grooves 112, thus being divided into twenty-four rows of lateral grooves 19. The drum is mounted on a shaft 106, running in the ball races 21 of the frame 94. There are also mounted on the shaft, a ratchet wheel 61, an elevating wheel 89, a drum dial 85, and a dial knob 107. The ratchet wheel has 160 teeth and is operated by the two ratchets 36 and 49. The drum dial is graduated from 1 to 160 and is illuminated by a pilot lamp. The dial is viewed through a window 82 and is read against a scale which is divided into three sections "in", "set", "out". Interposed between the window and the dial is a lens 83, supported in a mounting 84. The elevating wheel supports an internal gear, which turns around a stationary disc 91, having a guide groove and which is adapted to receive balls from the chute 117 and elevate them to the chute 92. The drum rotates in the cylindrical frame 94, having longitudinal guide grooves in its inner face (see Figure 2). The cylinder is supported by the frame 11 and has in its lower end twenty-four slots arranged so that if a ball enters any one of the longitudinal grooves of the drum it must pass by way of one of the slots and the chute 117 to the elevating wheel from which it is brought by way of the chute 92 and the ball magazine 87 to the shuttle 88, from which it is guided into one of the twenty-four channels 18.

At the end of each channel (see Figure 1) there is an opening 17, just large enough to hold two of the balls, which when the plunger 15 is not operated are prevented from entering a carrier groove by a spring. When a plunger 15 is operated, a single ball is pushed into a carrier groove in that row which corresponds to the respective plunger which is operated. Beneath the plunger is a sleeve containing another plunger 63 and a ball 62, which is prevented from leaving the sleeve because the diameter of the sleeve is somewhat restricted at the ball end. As one of the smaller balls in a carrier groove passes a steel ball 62 in one of the sleeves, the ball 62 is forced into the sleeve and the contact plunger 63 is operated. Slides 97 and 98, a detail of which is shown in Figure 5, are beneath each contact plunger and act to remove either one or all balls from the carrier grooves to the longitudinal or clearing grooves.

Referring to Figures 1 and 2, it is seen that the keyboard has twenty-eight keys which operate various mechanisms by lever systems. All the keys are similar in that they all operate a lever 5 which is pivoted at bearing 10 and when released a spring 4 in sleeve 3 forces the key back to its original position. Figure 1 shows a composite view of all the key lever mechanisms.

There are twenty-four numbered keys 101 the other four being marked "All out", "Step", "One out" and "Dial". In order not to be able to operate more than one key at a time, a locking device 26 (shown in detail in Figure 6) is employed. The locking device consists of a block bored and slotted as in the drawing to allow a number of balls 27, to be kept in line by a plunger, spring and screw arrangement, 135—134—123 (Fig. 6) and permitting the operation of one of the key levers 5, only, or the lever 24, operated by the switch 22.

When one of the numbered keys 101 is operated, one of the balls is pushed from one of the openings 17 into one of the carrier grooves of that row of grooves which corresponds to the key operated. This action is effected through the lever system 5—12—13—14—15 (Fig. 1). A pin 14 fastened to the lever 13 fits into a slot of the plunger 15 and a spring 16 acts to return the plunger when the key is released. Another action which accompanies the operation of a numbered key is the reciprocating motion given to the shuttle, by means of the following lever system, 5—57—60—111—114 (Figs. 1 and 2).

A third action accompanying the operation of a numbered key is the rotation of the drum one tooth. This is accomplished by means of the following mechanism: The system of levers 5—57—55—122 (see detail view Figure 4) gives a reciprocating motion to the piston 133 which is slotted to receive levers 122 and 31 and which is provided with a stop 129 and a shock absorber 130. The piston is connected to the core 30 of a magnet 28 supported by a block 29. The piston can be operated either magnetically or by pressing one of the numbered keys or the step key. The lever 31 actuates lever 34, one end of which is fitted with a roller 32 so as to reduce friction and the other end being shaped to form a bearing for the ratchet 36. A spring 38 is connected between the post 37 fitted to the ratchet and the post 39 fitted to the lever 34. Slide 42 running in the tracks 98 and 99 is forced against the lever 34 by the spring 43. A wheel 41 is mounted so as to rotate in one end of the slide 42. From this part of the description it is seen that the real motive power of the drum is the spring 43, while operation of the magnet, the step key, or one of the numbered keys acts to compress the spring only and to bring the ratchet 36 into the next tooth of the ratchet wheel.

Operating the "step" key causes the drum to be turned one ratchet tooth, and moves the shuttle as above described.

Operating the dial key releases the ratchets 36 and 49 so that the drum can be rotated freely and operates the shuttle in the same manner as the "step" or a numbered

key. The system of levers 5—6—7—44—110 actuate the sliding arm 46, both ends of which act as cams to release both ratchets.

Pressing the "all out" key releases the ratchet 36 and operates the shuttle and the "all out" slide 137 (shown in detail view, Figure 5). If the dial knob is then rotated all the balls in the carrier grooves of the drum are shifted from the guide grooves 115 of the cylinder to the clearing grooves 112 of the drum.

Operating the "one out" key moves the "one out" slide 97 so that the ball at the slide is transferred from the guide groove 115 to the clearing groove 112.

The plunger contact mechanism is supported on the cylinder by two insulated posts 77 and 78, and its sections 73 and 74 (Fig. 1) are held together by two sets of screws 75 and 76 and serve as the bearings for twenty-four plungers 65 which are connected by the insulated bushings 64 to the plungers 63. Two insulated sections 71 and 72 separate the pilot lamps and the resistance circuit contacts 69 and 70 of which there are twenty-four each. There are also twenty-four plunger contacts 68, which slide on the plungers 65 and are forced toward the stop 113 by the springs 67. Twenty-four springs 66 act on the plungers to force twenty-four balls 62 to the end of the sleeves in which the plungers are fitted.

A plunger contact circuit is closed whenever one of the balls set in a carrier groove passes a ball in the end of one of the sleeves because while it passes it pushes the ball into the sleeve, thus moving the plunger away from the drum and allowing the spring 67 to force a plunger contact 68 against a pilot lamp contact 69 and a resistance circuit contact 70, by which means, one of the pilot lamps 79 illuminates one of the numbers 81 of the indicating panel, and connection is made to one of the resistances in series 79.

Referring to Figure 7, which shows a wiring diagram, it is seen that the switch 22 controls the changeover from setting to printing or vice versa and the position of the switch is indicated by the pilot lamps 79, 79′. The switch is connected by means of a lever to the key-locking device so that no keys can be operated while the switch is in the printing position. The magnet 28 which is connected to the ratchet mechanism is included in the printing circuit. The magnet is operated by the breaker box 1 which is a circuit breaker which closes the circuit each time a notched film passes it. Each time the circuit is closed, the magnet and ratchet mechanism operates to turn the ratchet wheel one tooth and one of the contact plungers is acted upon by one of the balls travelling in the carrier grooves. Each plunger contact closes two circuits, one being a resistance circuit 70 by which means the voltage of the printer lamp is regulated, the other being a pilot lamp circuit by means of which the degree of printing exposure is indicated.

All the pilot lamps including the indicator, dial, setting, and printing pilot lamps, 8, 8, 79, 79′, require six volts, which is delivered from the secondary of a transformer 9, as shown in the diagram.

When the switch is changed from the printing to the setting position, the magnet and the printing pilot lamp circuits are opened, the keys are unlocked, and the setting pilot lamp circuit is closed.

In operation, the following instructions for operating the machines are to be followed in order to achieve the general purpose of the invention.

The keyboard automatic light

Change is designed to provide a simple and efficient means of timing and controlling the printing exposure, so that during the printing of motion picture film, a correct exposure is obtained for each scene of the negative. Any number up to 160 scenes can be timed, each scene timed for one of twenty-four exposure values. A novel check-up method is provided by means of which mistakes in setting the light change can be easily detected and corrected.

To set the machine, the first step is to put the switch in the setting position. This unlocks all the keys and lights the "setting" pilot bulb of the indicating panel. Operating the key marked "Dial" permits the dial knob (shown on the left in the drawings) to be rotated freely. The dial knob is turned until figure 1 of the dial is directly behind the section of the fixed scale marked "In" after which the "dial" key is released.

The machine is now set to record a series of light intensities in the same order as the exposures to be given the print. For instance, if inspection of a negative has shown that the first scene required exposure 5, key 5 is pressed down. If the next scene requires exposure 21, key 21 is operated. For each consecutive scene a key is operated, the number of the key representing the required degree of exposure.

Having timed all scenes, we are ready to set the machine for printing. The dial key is pressed down while the dial is rotated until figure 1 of the dial is directly behind the section of the fixed scale marked "Set", after which the dial key is released. The switch is put in the printing position which lights the "printing" pilot bulb of the indicating panel and locks all the keys. The machine will now in conjunction with the "breaker box" of the printing machine, regulate the voltage supplied to the printing lamp so that the proper sequence of light changes is obtained.

To make additional prints, it is necessary to bring figure 1 of the dial to the "set" position of the fixed scale before making each print. This is done as has already been described by putting the switch in the setting position, pressing the dial key while the dial is rotated until figure 1 of the dial is at the "set" position, releasing the dial key, and returning the switch to the printing position.

Any number of prints may be made from a negative with the same sequence of light changes. If, however, it is believed that a print can be improved by giving a different exposure to any one or more scenes, the exposure for any scene can be changed in the following manner:

The dial is set so that the dial number corresponding to the number of the scene, whose exposure is to be changed, is opposite "out", after which the "one out" key is pressed. Then set the dial so that the number is opposite "in", after which press the numbered key representing the new exposure intensity.

If it is desired to check the light changes for each scene with those given by the "printing card", the machine is set as for setting and the "step" key is made use of. Beginning with scene 1, which is in line with "set" when viewed through the dial window, the number representing the degree of exposure for that scene is flashed on the indicating panel. Pressing the "step" key brings scene 2 in line and the number representing the exposure intensity for the second scene is flashed on the indicating panel. Again pressing the "step" key, brings scene 3 in line and is accompanied by the flash of a number representing the degree of exposure for the third scene etc.

If it is desired to reset the machine, all the exposure values can be cut out of register by turning the dial one revolution, while pressing down the "all out" key. The machine can now be set again as previously described.

It will be understood that I have described and shown the preferred arrangement of my device as one example only of the many possible ways to practically construct the same and that I may make such changes in the construction of the minor details and general arrangement of my automatic light control device as come within the scope of the appended claims without departure from the spirit of my invention, and the principles involved.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a means for automatically locking the keys, said means comprising a block having an axial bore for the reception of a number of balls, and a plurality of slots for the passage of the key levers, and a switch lever, a plunger, spring and screw arrangement in said bore permitting the operation of one of the key levers only, and the switch lever selectively.

2. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a grooved drum adapted to receive balls, a cylinder in which said drum rotates, having longitudinal guide grooves in its inner face, a frame supporting said cylinder, said cylinder having twenty-four slots in its lower end, a chute upon which the balls from said drum are deposited through said slots, an elevating wheel for said balls, and a ball magazine into which said balls from said elevating wheel are deposited.

3. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a cylinder, a sectional plunger contact mechanism supported by insulated posts on said cylinder, two sets of screws holding the sections of said mechanism together, key operated plungers in said mechanism, sleeves for said plungers, and springs forcing a ball to the end of said sleeves and contacts for closing circuits by the operation of said plungers to illuminate pilot lamps.

4. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, an indicating panel, for registering a sequence of light changes, timing and printing means, means on said indicating panel showing whether the machine is set for timing or for printing, a drum dial, a window for the inspection of said dial, and a fixed scale against which said dial is readable, said scale blocked out into three suitably marked sections.

5. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a drum adapted to receive circuit closing balls, a shaft for said drum, a ratchet wheel on said shaft, and means for imparting to said drum a step by step motion said means comprising a system of levers, a slotted piston receiving a reciprocating motion from said system of levers, levers recessed in the slot of said piston, a stop for said piston, and a shock absorber, a magnet to the core of which said piston is connected, and a spring controlled slide controlling a ratchet in engagement with said ratchet wheel, said spring adapted to be compressed by a key to advance said drum for one step.

6. In a machine for automatically controlling the exposure lamps used in motion picture film printing machines, a rotating

drum, with carrier grooves for the reception of balls, and means to close a number of pilot lamp circuits individually and in a predetermined order, said means being operated by the balls inserted in the carrier grooves of the drum.

7. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a drum adapted to carry balls, a plurality of key operated levers to select balls from a supply and to insert the same into grooves in the surface of said drum, means to close a number of resistance circuits, individually and in a predetermined order by the action of said balls against a number of plunger contacts and means to indicate which resistance circuit is closed, said means consisting of a number of pilot lamps, one of which corresponds to each resistance circuit.

8. In a key operated machine for automatically controlling the exposure lamps used in motion picture printing machines, a drum adapted to receive circuit closing balls, means of clearing any one ball without changing the circumferential position of the other balls for effecting the removal of the exposure value registered for any particular scene of a reel of motion picture negative film without the necessity of changing the sequence of the exposure values registered for the other scenes, said means including a scene dial and a fixed scale, said dial adapted to be rotated until the scene number corresponding to the number of the scene the exposure value of which it is desired to clear is opposite the legend "Out" on the fixed scale, and an "out" key the operation of which clears the exposure value registered for that particular scene.

9. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a drum adapted to receive circuit closing balls, means of replacing a ball for one cleared ball for placing a new exposure value in register for one which has been cleared, said means comprising a scene dial and a fixed scale, said dial adapted to be rotated until the scene number corresponding to the number of the scene which has been cleared is opposite the legend "Set" on the fixed scale, and a key numbered to correspond to the new degree of exposure intensity for placing the new exposure value in register by its operation.

10. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, an indicating panel for indicating whether the machine is set in a timing or printing position, said panel when set for timing indicating the intensity of light which each scene is timed for, and when set for printing indicating the degree of light intensity for each consecutive scene.

11. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, including a switch controlling the timing and printing operations of the machine, a key locking system permitting of the operation of one key at a time only and preventing the registering of more than one exposure value for each scene when the machine is being set, and locking automatically all keys upon the setting of said switch controlling the timing or printing operations in the printing position for preventing accidental manipulation of the keys during the printing operation.

12. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, including a pilot lamp, a scene dial, a fixed scale on one side of said dial marked "In," "Set" and "Out" pointing to three different numbers on said scene dial, for exposing during the timing of the machine the number of the scene for which a light intensity value may be put in register, (indicated by "in"), or the number of the scene for which a light intensity value may be taken out of register (indicated by "out") and during the printing operation, the number of the scene which is being printed (indicated by "set") and the intensity of light with which that particular scene is being exposed (indicated at the time by the number on the indicating panel illuminated by said pilot lamp) and a step key for changing upon its depression during the setting of the machine the relation to the fixed scale, to the numbers on the scene dial, the depression of said "step" key rotating the scene dial for an equal step on each depression of the key, and a "dial" key rotating the scene dial upon its depression.

13. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, a ball magazine and balls therein, and an internal gear and stationary disc mechanism for elevating and returning cleared balls into said magazine.

14. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, including a fixed scale and a switch, a dial key, means for reproducing prints by pressing the dial key permitting the dial to be rotated until scene Number 1 is opposite the mark "set" on the fixed scale, and means for returning the switch to the printing position.

15. In a key operated machine for automatically controlling the exposure lamps used in motion picture film printing machines, including manually operated keys

and a magnetic circuit, a drum having circumferential grooves for retaining balls and longitudinal grooves for clearing balls, means to impart to said drum a rotary motion in equal steps by the manual operation of said keys and the interruption of the magnetic circuit, means for rotating said drum without changing any balls from their relative circumferential positions, a stationary cylinder having longitudinal guide grooves in its inner face, a key operated sliding member for removing any one of the balls from a guide groove of the cylinder to a clearing groove of the drum, and a key operated sliding member for shunting all balls from their circumferential positions on the drum into the clearing grooves of the drum, and a chute for passing the balls from said clearing grooves to an elevating mechanism for their return to the ball magazine.

Signed at New York, in the county of New York, and State of New York, this 23rd day of September, A. D. 1931.

KURT SCHNEIDER.