March 3, 1942. M. W. HANKS 2,275,143

TIME SWITCH

Filed March 15, 1940 3 Sheets-Sheet 1

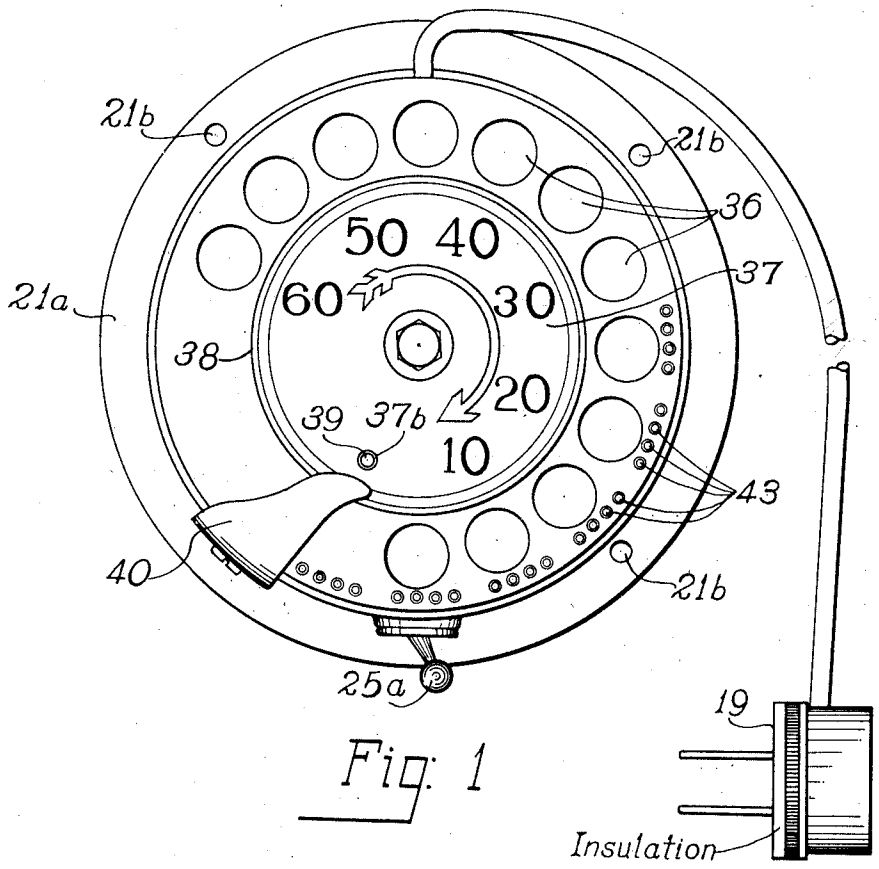


Fig. 1

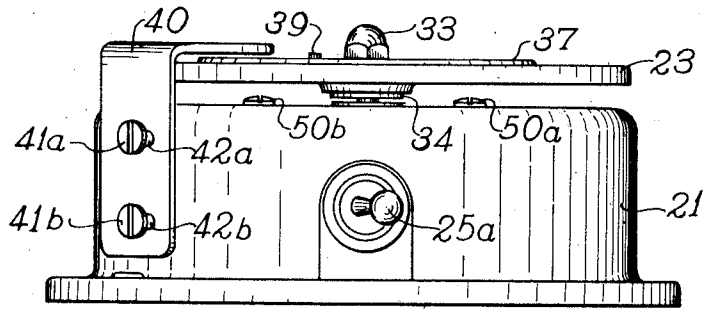


Fig. 2

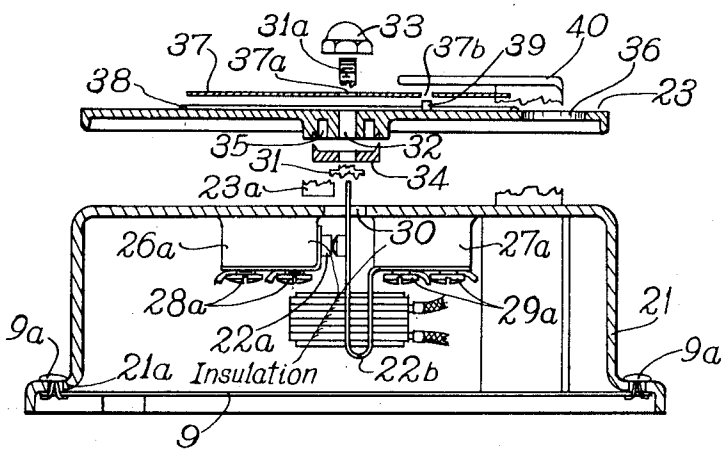
INVENTOR
Marshall W. Hanks
BY
Davis, Lindsey, Smith & Shouts
ATTORNEYS

March 3, 1942. M. W. HANKS 2,275,143

TIME SWITCH

Filed March 15, 1940 3 Sheets-Sheet 2

Fig. 4



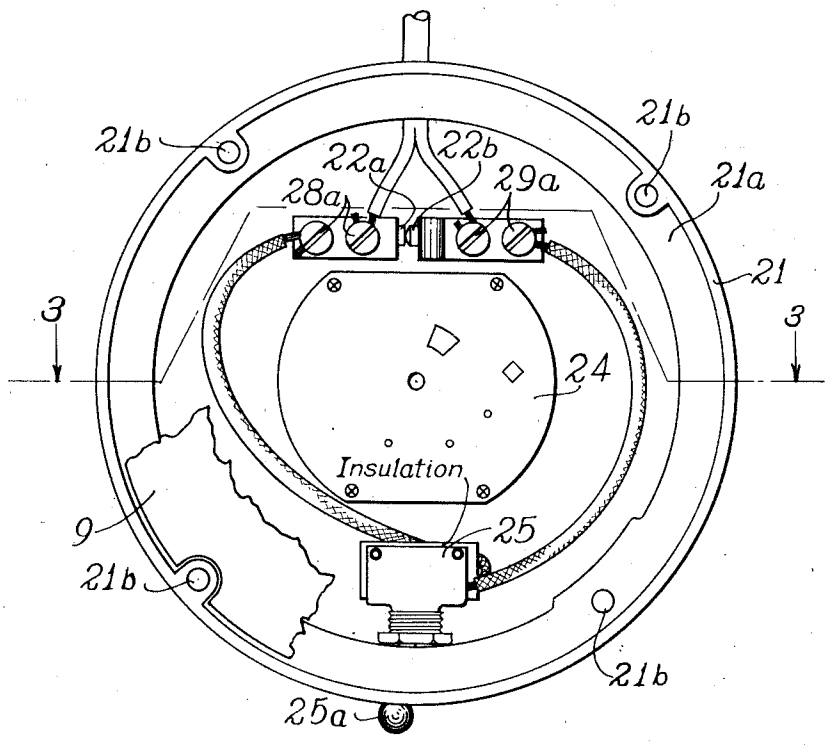


Fig. 3

INVENTOR
Marshall M. Hanks
BY
Davis, Lindsey, Smith & Shoutz,
ATTORNEYS

March 3, 1942. M. W. HANKS 2,275,143

TIME SWITCH

Filed March 15, 1940 3 Sheets-Sheet 3

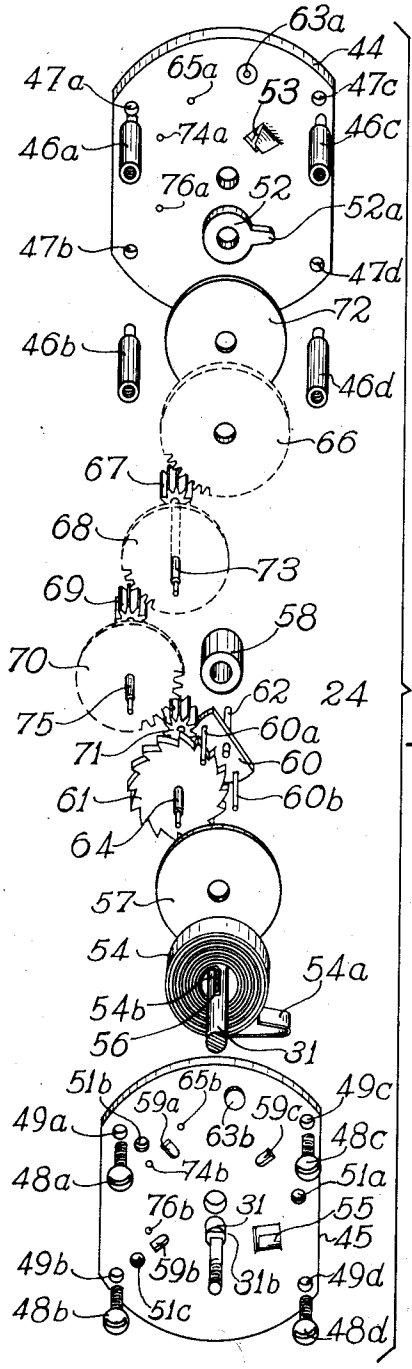


Fig. 5

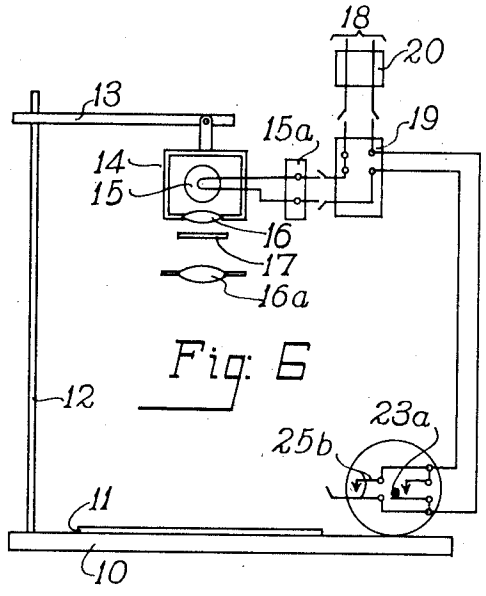


Fig. 6

INVENTOR
Marshall M. Hanks
BY
Davis, Lindsey, Smith & Shonts,
ATTORNEYS.

Patented Mar. 3, 1942

2,275,143

UNITED STATES PATENT OFFICE

2,275,143

TIME SWITCH

Marshall W. Hanks, Madison, Wis., assignor to Hankscraft Company, Madison, Wis., a corporation of Wisconsin

Application March 15, 1940, Serial No. 324,023

7 Claims. (Cl. 200—35)

The present invention relates to photographic printing apparatus and more particularly to improvements in timing apparatus particularly applicable for use in controlling the energization of photographic exposure lamps.

It is an object of the present invention to provide improved apparatus of the character described which is of simple and economical arrangement and may easily be operated to provide positive and accurate control of photographic exposures.

It is a further object of the invention to provide improved apparatus of the character described which is so constructed and arranged that a dial provided with time indexed finger-receiving recesses may be utilized as the time control element, thereby to provide accurate control of the energization of the exposure lamp for any selected one of different time intervals.

It is another object of the invention to provide improved apparatus of the character described which is so arranged that the energization of the exposure lamp is initiated when the dial is moved off-normal and wherein provisions are made for compensating for the period required manually to operate the dial from its normal position to the selected predetermined off-normal position, whereby the actual period of energization of the lamp will accurately correspond to the off-normal position to which the dial is operated.

It is still another object of the invention to provide an improved actuating dial adapted for use in apparatus of the character described which is provided with two sets of operating recesses arranged to permit rapid operation of the dial and accurate selection of the required time intervals.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawings in which Figure 1 is a top elevational view of an improved photographic exposure timing device constructed and arranged in accordance with the present invention; Fig. 2 is a side view of the timing device illustrated in Fig. 1; Fig. 3 is a bottom view of the same device; Fig. 4 is an exploded side sectional view taken along the lines 3—3 of Fig. 3; Fig. 5 is an exploded view of the operating motor embodied in the device shown in Fig. 1; and Fig. 6 illustrates the circuit arrangement of photographic exposure apparatus having the features of the present invention embodied therein.

Referring now more particularly to Fig. 6 of the drawings, the apparatus there illustrated comprises a supporting base 10 having a print support 11 positioned thereon and provided with an upstanding pedestal 12 which carries at its upper end an adjustable transversely extending bracket 13. The free end of this bracket carries a lamp enclosing fixture 14 within which is mounted, in any desired manner, an exposure lamp 15. The lamp enclosing fixture 14 is provided in its lower wall with a light-emitting aperture in which is mounted a light condensing lens 16. The apparatus further includes a diverging lens 16a and a film holder 17 which is provided with a film slot in the usual manner. The lens 16a and the holder 17 may be supported from the pedestal 12 in any suitable manner such that relative movement between the holder, the print support 11, the lens 16a and the lens 16 may be obtained. For the purpose of energizing the lamp 15 there is provided an operating circuit which includes circuit conductors interconnecting the lamp with a commercial frequency current source 18. More specifically, the terminals of the lamp 15 are connected to the terminals of a receptacle plug 15a which may be inserted in the outlet top of a second plug 19. The plug 19 is provided with contact members which may be inserted in a receptacle outlet 20, for example, to which the current source 18 is connected. In one side of the circuit for energizing the lamp 15 there is included the control contacts of the timing apparatus illustrated in Figs. 1 to 5, inclusive, of the drawings.

Briefly described, this timing apparatus comprises an inverted cup-shaped casing 21, a pair of circuit control contacts 22a and 22b and an actuating element in the form of a dial 23 which is operable from the normal position illustrated in the drawings to any one of a number of off-normal positions, thereby to permit the contacts 22 to be moved into engagement. For the purpose of returning the dial 23 to its normal position following operation thereof to one of its off-normal positions there is provided a driving motor 24. In order to enable the energization of the exposure lamp 15 to be controlled independently of the contacts 22a and 22b, there is further provided a manually operable snap switch 25 which is mounted upon the side wall of the casing 21 and includes an operating element 25a

through operation of which the contact springs 25b thereof are controlled.

Preferably, the casing 21 is formed of molded Bakelite or other phenolic condensation products, a pair of mounting ledges 26a and 27a being formed integral with the top wall thereof to provide supporting surfaces for the contact elements 22a and 22b respectively. The casing 21 is provided with a flared base portion which forms a supporting ledge 21a. A closure plate 9 is fixedly mounted upon this ledge by means of split rivets 9a which extend through suitable openings provided in the flared portion of the casing and registering slots provided in the closure plate. Additional openings 21b are provided in the flared base portion of the casing 21 for the purpose of receiving mounting screws or bolts. The two contact elements 22a and 22b are mounted upon the ledges 26a and 27a respectively by means of terminal screws 28a and 29a which extend through holes in the contact elements and are respectively threaded into the ledges 26a and 27a. The free end of the movable contact element 22b is substantially U-shaped and is provided with a projecting portion which extends through an opening 30 formed in the top wall of the casing 21 so that movement may be imparted thereto under the control of the dial 23.

The dial 23 is mounted upon the upper end of the operating or drive shaft 31 embodied in the driving motor 24. More specifically, the drive shaft 31 is provided with a portion 31a of reduced cross section which extends through an opening 32 drilled through the center of the dial 23 and is threaded at its upper end to cooperate with the mating threads of an assembly cap 33. The assembly for mounting the dial 23 upon the drive shaft 31 further comprises a collar 34 which is slotted to mate with a substantially rectangular shoulder 31b formed at the point of reduced cross section of the shaft 31, thereby to prevent relative movement between the shaft and collar. This collar is provided around the upper peripheral surface thereof with sharp teeth which extend upwardly and are arranged to bite into the adjacent underside of the dial 23 when the assembly cap is screwed onto the end of the shaft 31. In order to facilitate this biting engagement between the teeth of the collar 34 and the adjacent surface of the dial 23, an annular recess 35 is formed in the underside of the dial in the manner illustrated. For the purpose of limiting the forward movement of the dial 23 during operation of the device, there is provided a stop member 40 which is mounted upon the casing 21 by means of screws 41a and 41b threaded into the side wall of the casing. This stop is provided with a portion overlying the dial 23 to arrest movement of the dial in the forward direction by engaging an operator's finger or other instrument which has been inserted in one of the operating recesses for the purpose of operating the dial. More specifically, the mounting portion of the finger stop member 40 is provided with transversely extending slots 42a and 42b through which the mounting screws 41a and 41b respectively extend, thereby to permit adjustment of the stop relative to the dial 23.

The dial 23 is preferably formed of a molded plastic material and is provided on its underside with a projection 23a which normally engages the free end of the contact spring 22b to hold the contact carried by this spring out of engagement with the associated contact 22a and functions to release the spring 22b so that the contact carried thereby may engage the contact 22a when the dial 23 is moved off-normal. It will be understood that by loosening the cap 33 the position of the dial 23 relative to the shaft 31 may be shifted to move the projection 23a to the proper position for holding the contacts 22 out of engagement. The cap 33 may then be tightened and the locking collar 34 will hold the dial 23 in its new position. The dial 23 is provided around the outer periphery thereof with a plurality of finger-receiving recesses or openings 36 which are of the same size and are evenly spaced apart. The spacing between the centers of each adjacent pair of these openings designates a particular increment of time which is determined by the speed of operation of the driving motor 24. The time intervals respectively designated by these finger-receiving recesses are printed or otherwise inscribed upon an index plate 37 which is disposed within an annular rib 38 formed integral with the dial 23 and is provided with an opening 37a which registers with the aperture 32 formed in the dial 23, thereby to receive the portion 31a of the drive shaft 31. A second opening 37b is provided in the index plate 37 which cooperates with a projection 39 formed integral with and extending upwardly from the dial 23 in order to prevent relative movement between this plate and the dial.

As indicated by the numbers inscribed upon the index plate 37 opposite certain of the finger-receiving recesses 36, these recesses respectively designate rather large intervals of time. In order to provide for operation of the device to measure intermediate intervals of time not designated by the recesses 36, an additional set of more closely spaced recesses 43 is provided, these additional recesses being disposed around the extreme outer edge of the dial 23. In the preferred arrangement of the device, the finger-receiving recesses 36 are evenly spaced apart to designate time intervals which increase in five second steps and the additional recesses 43 are more closely spaced so that the spacing between adjacent centers thereof designate an interval of one sec ond. The latter recesses are necessarily of smaller diameters and preferably extend only part way through the dial to receive the sharpened end of a pencil or the sharp point of another suitable instrument.

The driving motor 24 is illustrated in Fig. 5 of the drawings as being of the spring operated escapement controlled type. More specifically, this motor comprises a supporting structure which includes a pair of assembly plates 44 and 45 and four assembly posts 46a, 46b, 46c and 46d. The upper ends of these posts are respectively formed of reduced cross section and respectively extend through holes 47a, 47b, 47c and 47d drilled in the supporting plate 44. These ends of the post 46 are swedged over so that the posts are rigidly secured to the supporting plate 44. The opposite ends of the posts 46 are drilled and tapped to receive screws 48a, 48b, 48c and 48d which extend through registering openings 49a, 49b, 49c and 49d, respectively, drilled in the other supporting plate 45. The motor assembly is mounted upon the upper wall of the casing 21 by means of three mounting screws, two of which are indicated at 50a and 50b, which extend through openings formed in the upper wall of the casing 21 and are respectively threaded into tapped drilled holes 51a, 51b and 51c provided in the assembly plate 45. The normal position of the

drive shaft 31 and the dial 23 is defined by a collar 52 which is rigidly mounted upon the shaft 31 and is provided with a finger 52a normally engaging a stop element 53 carried by the assembly plate 44. Preferably, the stop element 53 comprises a tongue which is cut and bent out from the assembly plate 44 normally to engage the finger 52a and thus prevent the shaft 31 from being operated past its normal position. In order to drive the shaft 31 and the dial 23 back to normal following operation of these elements to an off-normal position, spring driving means are provided which comprise a coil spring 54 having one end 54a thereof anchored to a tongue 55 which is cut and bent inwardly from the assembly plate 45. The opposite or inner end 54b of the coil spring 54 is anchored in a slot 56 which is formed in the shaft 31. Axial movement of the convolutions of the spring 54 is prevented through the provision of a plate 57 which is carried by the shaft 31 between the spring 54 and a spacing collar 58. This collar is preferably rigidly mounted upon the shaft 31 so that the convolutions of the spring 54 are held in position between the plate 57 and the adjacent surface of the assembly plate 45. In order to prevent undue expansion of the convolutions of the spring 54 as the tension of this spring is relaxed during operation thereof to drive the shaft 31 to normal, a plurality of tongues 59a, 59b and 59c are provided which are cut and bent inwardly from the assembly plate 45 to define an annular space within which the spring may operate.

For the purpose of holding the speed of rotation of the drive shaft 31 substantially constant after the dial 23 is operated to one of its off-normal positions and then released, there is provided an escapement type of governor mechanism which comprises a pallet 60 and an escapement wheel 61. The pallet 60 carries a pair of escapement arms 60a and 60b and is mounted upon a shaft 62 which is journaled at its opposite ends in bearing members 63a and 63b respectively mounted within openings formed in the assembly plates 44 and 45. The escapement wheel 61 is mounted for rotation with a shaft 64 having ends of reduced diameter which are journaled in bearing openings 65a and 65b respectively provided in the assembly plates 44 and 45. For the purpose of driving the escapement wheel 61 during return movement of the shaft 31 to its normal position, a plurality of gears 66, 67, 68, 69, 70 and 71 are provided which form a driving connection between the shaft 31 and the ratchet wheel 61. This driving connection also includes a slip or clutch mechanism which is provided for the purpose of permitting the shaft 31 to be rotated away from its normal position, thereby to tension the coil spring 54 without operation of the associated gears and governor mechanism. More specifically, the gear 66 is loosely mounted for rotation about the shaft 31 between the collar 58 and a clutch plate 72. The clutch plate 72 and the collar 58 are rigidly secured to the shaft 31 and preferably the plate 72 is slightly dish-shaped, whereby the gear 66 is resiliently urged against the collar 58 to provide a slip drive connection between this gear and the shaft 31. The pinion 67 and the gear 68 are both mounted for rotation with a shaft 73 which is provided with opposite ends of reduced diameter that are journaled in bearing openings 74a and 74b respectively formed in the assembly plates 44 and 45. Similarly, the pinion 69 and the gear 70 are both mounted for rotation with a shaft 75 which is provided with opposite ends of reduced diameter that are journaled in bearing openings 76a and 76b respectively formed in the assembly plates 44 and 45. The pinion 71 is mounted for rotation with the shaft 64 upon which the ratchet wheel 61 is mounted. The manner in which the various elements of the motor 24 are assembled will be apparent to one skilled in the art without further explanation.

In utilizing the above-described apparatus for the purpose of printing photographic enlargements, for example, the plug 15a is inserted in the jack portion of the connector element 19 and the plug portion of this element is inserted in a suitable receptacle jack 20, thereby to prepare the operating circuit for the exposure lamp 15. The film which is to be reproduced is next positioned on the film holder 17 and the relative positions of this holder, the light source 15, the print support 11, and the lens 16a are adjusted to obtain the desired focus and the desired degree of enlargement. During such adjustment it will usually be found necessary to move the actuating element 25a of the switch 25 to its closed circuit position so that the contacts 25b are operated into engagement to complete the circuit for energizing the lamp 15. With this lamp energized, the light source 15 may be adjusted relative to the lens 16a and the print support 11 so that the desired size of the light beam is obtained. The film holder 17 may then be adjusted to the proper position and the switch 25 may be operated to its normal position to open the circuit for energizing the lamp 15, following which the printing paper may be planed on the support 11 in the proper position for exposure when the lamp 15 is again energized.

Following these operations, the operator may operate the dial 23 to the off-normal position corresponding to the calculated exposure time by inserting a finger in the appropriate finger-receiving recess 36 and rapidly rotating the dial 23 until the inserted finger engages the finger stop 40. If the calculated exposure time does not correspond to an interval designated by one of the finger-receiving recesses 36, the operator may insert the end of a pencil or other sharp instrument in an appropriate one of the recesses 43 and operate the dial 23 either by finger manipulation or otherwise, until the inserted instrument engages the finger stop 40. Immediately the dial 23 is moved off-normal, the projection 23a carried by the underside of this dial is moved out of engagement with the free end of the contact spring 22b, whereby the contact carried by this spring is moved into engagement with the contact 22a to complete the circuit for energizing the exposure lamp 15. Thus, the exposure interval is started. During the forward movement of the dial to the selected off-normal position the shaft 31 is rotated away from its normal position to tension the coil spring 54. Operation of the governor mechanism and of the associated gear train embodied in the motor 24 during such movement of the dial is prevented due to engagement of one of the escapement arms 60a and 60b with one of the teeth of the ratchet wheel 61. The previously mentioned slip connection comprising the clutch plate 72 and the loosely mounted gear 66 permits such rotation of the shaft 31 to tension the coil spring 54 without operation of the associated gear train and governor mechanism. When the dial 23 has been operated to the off-normal position corresponding to

the selected time interval, such that the operating instrumentality inserted in one of the recesses 36 or 43 engages the finger stop 40, the dial is promptly released. In response to the release of the dial the tension coil spring 54 functions to drive the shaft 31 back to its normal position. During such rotation of the shaft 31, the ratchet wheel 61 is rotated through operation of the gears 66, 67, 68, 69, 70 and 71 and the slip connection comprising the clutch plate 72. Due to the coaction of the pallet 60 and the ratchet wheel 61, the speed at which the shaft 31 is returned to normal is maintained substantially constant. During the final movement of the shaft 31 toward its normal position, the projection 23*a* carried by the underside of the dial 23 engages the projecting end of the contact spring 22*b* to move the contact carried by this spring out of engagement with the contact 22*a* and thus break the circuit for energizing the exposure lamp 15. As a result, the exposure interval is terminated. When the shaft 31 is fully returned to its normal position the finger 52*a* of the collar 52 engages the stop 53, thereby to arrest the operation of the motor 24. It will be understood that when this occurs the dial 23 again occupies its normal position.

During the interval when the lamp 15 is energized, the light generated thereby is projected through the condensing lens 16, the film carried by the work support 17 and the diverging lens 16*a* onto the printing paper carried by the support 11. As a result, the picture carried by the film disposed on the support 17 is latently inscribed upon the printing paper carried by the support 11. After these operations have been performed, the exposed paper may successively be subjected to a developing bath, a fixing bath and one or more rinsing baths, in the usual manner.

From the foregoing explanation it will be apparent that the interval during which the exposure lamp 15 is energized is determined by the period required to operate the dial 23 to the selected off-normal position and the further period required for this dial to be returned to its normal position under the control of the motor 24. Under ordinary circumstances the first of these periods is relatively short as compared with the second interval and usually will not exceed one second. By suitable adjustment of the finger stop 40 relative to the position of the dial 23, the first interval, namely, that required to operate the dial to a selected off-normal position corresponding to a desired exposure interval, may be compensated for. Thus, if relatively long exposure intervals are being utilized in printing a group of pictures such that approximately one second is required to operate the dial 23 to the off-normal position corresponding to the desired exposure interval, the mounting screws 41*a* and 41*b* may be loosened and the position of the finger stop 40 shifted so that the finger engaging edge thereof coincides with the adjacent circumference of the first recess 43. After shifting the finger stop 40 in this manner, the screws 41*a* and 41*b* may be tightened to fix the stop in the new position. It will be understood from the foregoing explanation that by utilizing the finger-receiving recesses 36 and the additional set of recesses 43, any desired exposure interval ranging from one to thirty or more seconds may be obtained. In the arrangement illustrated, the additional recesses only extend around the portion of the circumference of the dial representing the first thirty-second time interval, but it will be understood that these recesses may, if desired, be further extended to cover the entire outer edge of the dial.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. Apparatus for controlling the energization of a photographic exposure lamp comprising a pair of contacts for controlling the operating circuit for said lamp, a dial provided with finger-receiving recesses spaced to designate relatively long increments of time and with an additional set of recesses spaced to designate smaller increments of time, and means including said dial for controlling said contacts to complete said circuit for any selected one of different time intervals respectively corresponding to said recesses.

2. A timing device comprising an inverted cup-shaped casing provided with an opening in the top wall thereof, a pair of contacts mounted within said casing, a spring carrying one of said contacts and including a portion projecting through said opening, a dial rotatably mounted above the top wall of said casing, said dial being provided with finger-receiving recesses spaced to designate relatively long increments of time and with an additional set of recesses spaced to designate smaller increments of time, and means comprising a projection carried by said dial and cooperating with the projecting portion of said contact spring for operating said contact spring to a predetermined circuit controlling position for any selected one of different time intervals respectively corresponding to said recesses.

3. A timing device comprising an inverted cup-shaped casing provided with an opening in the top wall thereof, a pair of contacts mounted within said casing, a spring carrying one of said contacts and including a portion projecting through said opening, a dial having a normal position and provided with spaced-apart operating recesses individually corresponding to different off-normal positions of said dial, said dial being mounted for rotation above said casing and including a projection normally restraining said contact spring so that said contacts are out of engagement and operative to permit engagement of said contacts when said dial is moved off-normal, driving means conditioned for operation in response to operation of said dial to one of its off-normal positions and operative to drive said dial to its normal position when said dial is moved off-normal and then released, and means comprising a governor driven by said driving means for maintaining substantially constant the speed of said dial during its return movement, whereby different time intervals respectively corresponding to said off-normal positions are required to return said dial to normal.

4. A timing device comprising an inverted cup-shaped casing provided with an opening in the top wall thereof, a pair of contacts mounted within said casing, a spring carrying one of said contacts and including a portion projecting through said opening, a dial having a normal position and provided with finger-receiving recesses spaced apart to designate different off-normal positions and an additional set of recesses

spaced apart to designate different intermediate off-normal positions of said dial, said dial being mounted for rotation above said casing and including a projection normally restraining said contact spring so that said contacts are out of engagement and operative to permit engagement of said contacts when said dial is moved off-normal, driving means conditioned for operation in response to operation of said dial to one of its off-normal positions and operative to drive said dial to its normal position when said dial is moved off-normal and then released, and means comprising a governor driven by said driving means for maintaining substantially constant the speed of said dial during its return movement, whereby different time intervals respectively corresponding to said off-normal positions are required to return said dial to normal.

5. A timing device comprising an inverted cup-shaped casing provided with an opening in the top wall thereof, a pair of contacts mounted within said casing, a spring carrying one of said contacts and including a portion projecting through said opening, a dial having a normal position and provided with finger-receiving recesses spaced apart to designate different off-normal positions and an additional set of recesses spaced apart to designate different intermediate off-normal positions of said dial, said dial being mounted for rotation above said casing and including a projection normally restraining said contact spring so that said contacts are out of engagement and operative to permit engagement of said springs to complete said circuit when said dial is moved off-normal, driving means conditioned for operation in response to operation of said dial to one of its off-normal positions and operative to drive said dial to its normal position when said dial is moved off-normal and then released, means comprising a governor driven by said driving means for maintaining substantially constant the speed of said dial during its return movement, whereby different time intervals respectively corresponding to said off-normal positions are required to return said dial to normal, and an adjustable stop mounted upon said casing and overlying said dial to limit the forward movement of said dial when said dial is moved off-normal.

6. An operating member for a timing device comprising a dial provided with a plurality of spaced-apart finger-receiving recesses and an additional set of spaced-apart recesses, the spacing between each adjacent pair of said finger-receiving recesses designating a relatively large increment of time, and the spacing between each adjacent pair of said additional recesses designating a smaller increment of time.

7. An operating member for a timing device comprising a dial provided with a plurality of spaced-apart finger-receiving recesses defining an arc having a predetermined radius and an additional set of recesses defining an arc of greater radius than said predetermined radius, the spacing between each adjacent pair of said finger-receiving recesses designating a relatively large increment of time, and the spacing between each adjacent pair of said additional recesses designating a smaller increment of time.

MARSHALL W. HANKS.