

May 1, 1945.

L. P. MORRIS

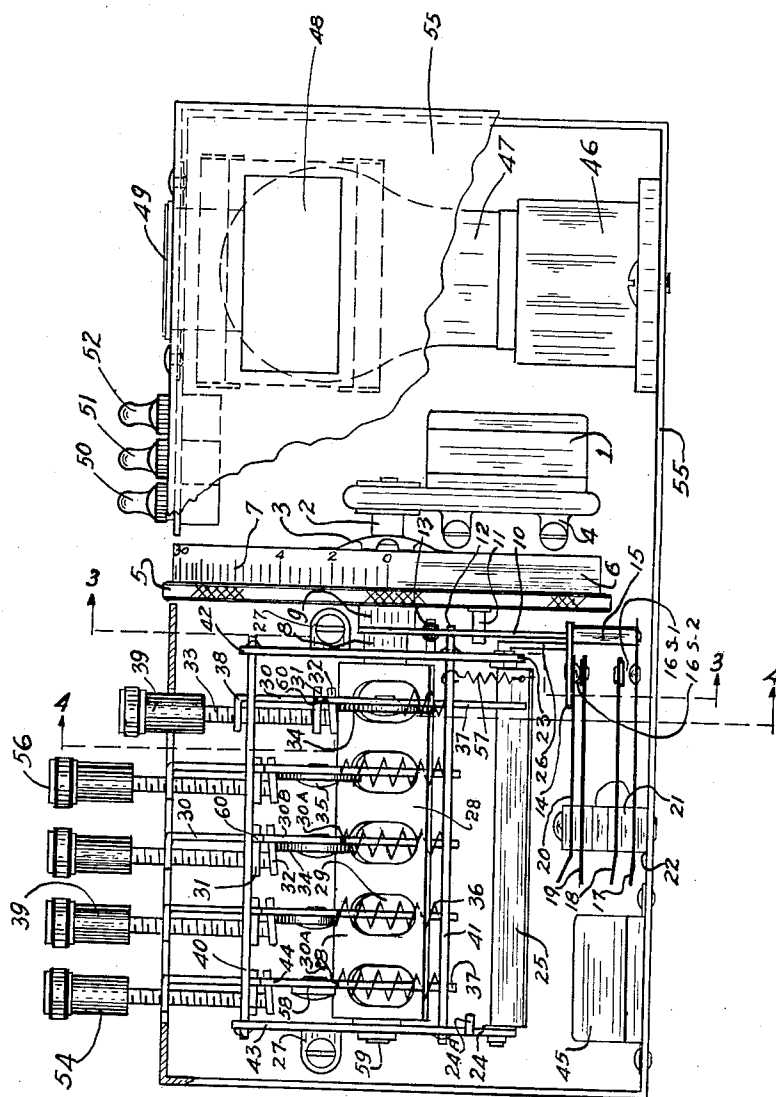
2,374,946

INTERVAL TIMER

Filed March 4, 1940

4 Sheets-Sheet 1

Fig. 1



INVENTOR.
Lloyd P. Morris

May 1, 1945.

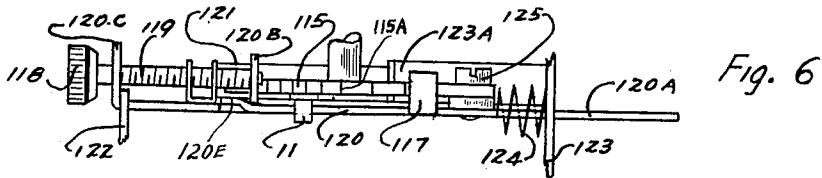
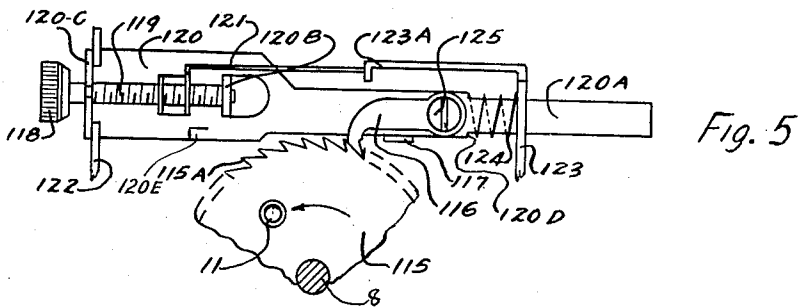
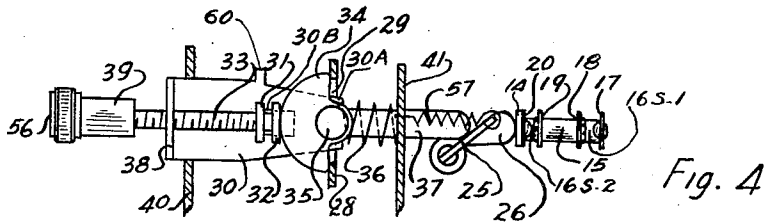
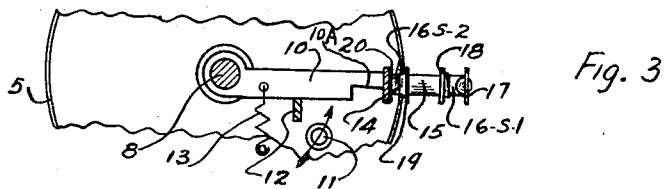
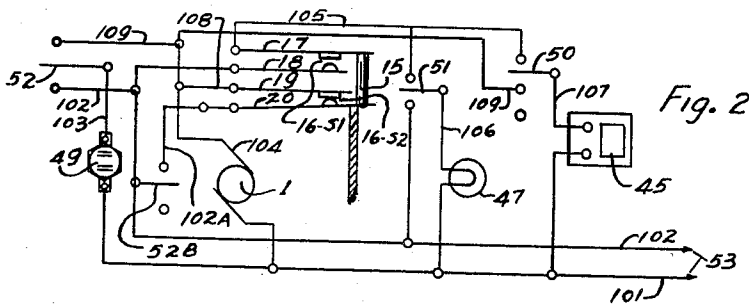
L. P. MORRIS

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INVENTOR.

INVENTOR:
Lloyd P. Morris

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L. P. MORRIS

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Fig. 9

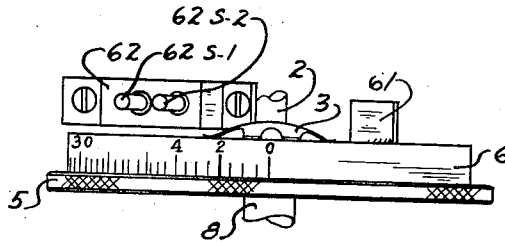


Fig. 7

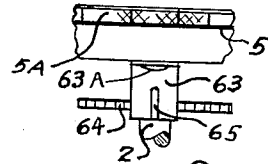
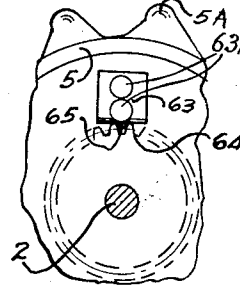


Fig. 8



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Fig. 14

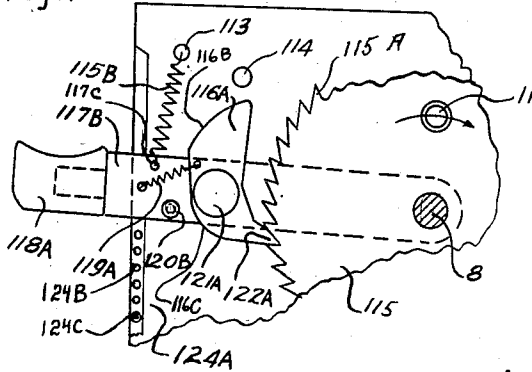


Fig. 15

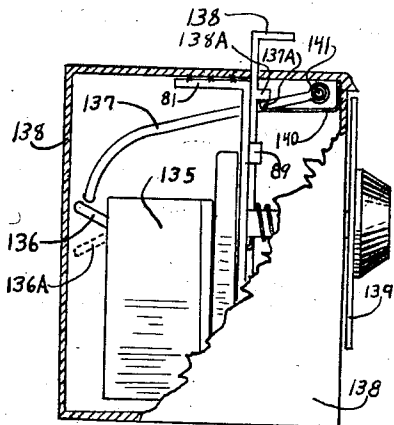
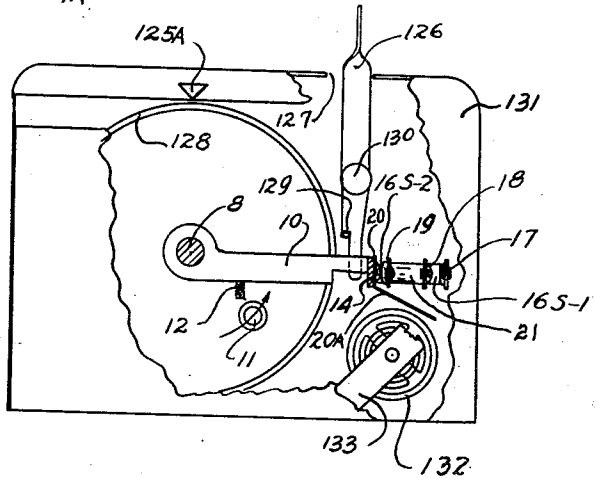


Fig. 16

INVENTOR.
Lloyd P. Morris

UNITED STATES PATENT OFFICE

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INTERVAL TIMER

Lloyd P. Morris, Chicago, Ill.

Application March 4, 1940, Serial No. 322,131

15 Claims. (Cl. 161—1)

This invention relates to a new and improved interval timer which may be quickly and selectively set up with a push button, or other single operation means, to control an electrical circuit or give a visible or audible indication during or following a desired interval of time.

Among the timers of the types now appearing on the market, there does not seem to be any that may be conveniently started and operated with a push button or other single operation means, or that is as simple and free from electro-mechanical complications as the timing device here about to be described.

It is acknowledged that push buttons or levers are manually operable, but for the sake of definition for this disclosure manual operation is considered the non-automatic setting of the main continuously variable timer dial indicator to any value within the range of the instrument and later starting the release or start button to begin the controlled interval.

While the present construction may be used for any type of timing, such as the control of electrical circuits, visible or audible timing operations, it is particularly adapted to photographic uses.

One of the most important objects of this disclosure is to provide a single operation interval timer for photographic and other uses which may be started to operate for a preselected time by a single operation of one of a multiplicity of push buttons or levers.

A second object is to furnish a timing apparatus which operates without complicated or costly electrical circuit making or breaking switching means, and thus give the prospective user an increased value in timers.

Another object is to make available a timer which in addition to controlling an electrical power circuit will give a visual or audible signal, selectively as the user may desire.

Still another object of this development is to supply a timing instrument that may be more particularly applicable to photographic uses by supplying a selected filtered portion of the visible light spectrum for specific dark room illumination required in the processing of light sensitive photographic emulsions.

Inasmuch as the operator in a photographic dark room may not desire to have the dark room lamp on while photographic picture emulsions are being exposed in contact or projection printers, it is another object that this device allow the selective control of the dark room light during this interval.

It is yet another object to supply means on the instrument to allow the operator to conveniently set the instruments for odd or occasional time intervals which may not coincide with the time intervals already set up selectively on the straight motion push buttons, levers, or other single push operation means; and in such a manner as to not change or interfere with the time setting of these single push means of control.

An object is to afford a timer which may be selectively preset for the desired time interval—that is to permit the interval to start at any time after the setting operation has taken place, at the operator's will, and to perform this operation without any change in the time setting controls.

Another object of this device is to permit the time interval to be changed at will after the beginning of the interval without any circuit switching or preliminary adjustments. This object applies to both the push button and manual preselection and does not change the time interval for which any of the push buttons have been set up.

Another object is to provide an apparatus for push button timer control in which the push buttons are all selectively settable easily and without tools by the user, for different values within the range of the instrument.

An additional object is to permit the total time interval to be made continually longer without instrument changes by merely pushing additional buttons for the additional time required: for example, with four push buttons set for, say, 5, 10, 20, and 40 seconds each, the electrical circuits may be on for any of the following time intervals: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, and 75 seconds without changing the setting of any one of the four buttons.

Other objects, advantages, and economies will be apparent upon examination of the drawings, specifications, and claims.

In the drawings:

Fig. 1 is a horizontally viewed vertical section of one form of the timing device, with the enclosing case partly cut away, and with one push button depressed.

Fig. 2 is a diagram of the electric connections of one of the preferred forms of the apparatus to better indicate the sequence of operation.

Fig. 3 is a section taken substantially on line 3—3 of Fig. 1, showing the operation of the quick-action release switch.

Fig. 4 is a vertical section substantially on line

4-4 of Fig. 1, showing the particular push button plunger and reset mechanism of Fig. 1.

Fig. 5 is a section of a form of the device using one push button.

Fig. 6 is a bottom view of the device of Fig. 5.

Fig. 7 is a top view of the device shown in Fig. 8.

Fig. 8 illustrates a device that combines the clutch and a means for presetting for any number of seconds.

Fig. 9 shows alternate switching means that may be substituted for that shown in Fig. 1.

Fig. 10 is a section of a single button interval setting device.

Fig. 11 is a section taken on line 11-11 of Fig. 10.

Fig. 12 is a section taken on line 12-12 of Fig. 13, a preferred form of the device.

Fig. 13 is a front view, partially cut-away, of the device of Fig. 12, with the circuits and motor shown diagrammatically.

Fig. 14 is a sectional view of a lever-operated interval setting timer.

Fig. 15 shows a view, partly cut-away, of a mechanically stopped timer.

Fig. 16 shows a view, partly cut-away, of a non-selfstarting timer.

A detailed description of preferred forms of this push button interval timer is given here following without any intention of limiting the general scope or applications intended.

The apparatus is enclosed in an appropriate case and is composed in the main of a clock motor driving a time dial through a friction or locking drive in such a manner that after a given preset predetermined time, the time dial causes appropriate means to operate the electrical switching and indicating means; associated also are push buttons, other single operation controls or manuals which set the time dial to a predetermined position so as to operate for the interval for which the particular button was set up. The setting of the push buttons or manuals can be changed at will.

In Figure 1 the clock motor 1, supported on bracket 4, drives shaft 2, friction clutch 3, and clock dial 6 with its time indicia 7 and setting wheel 5, rigidly mounted on shaft 8. The dial setting wheel 5 carries a rigid pin 11, Figs. 1 and 3, so situated as to travel toward a switch-release bar 10 freely mounted on shaft 8. A tension spring 13 retains bar 10 normally against a mechanical stop 12. When bar 10 is in the illustrated position against stop 12, its end lies against the spring switch combination 17, 18, 19, 20 and electrical insulator 14, and restrains them outwardly radially in a direction away from shaft 8. In this "set" or running position, the contact points 16S2 of switch blades 19 and 20 are held closed by bar 10, while contact switch points 16S1 are held open against their inherent spring tension by the insulating spacer 15, which in turn is held in the outward radial position by switch-release bar 10. When the pin 11 on the dial wheel 5 has been driven around to contact switch release bar 10, it continues to move this bar 10 ahead of it until the spring switch combination returns inwardly radially toward shaft 8 a small amount. (It should be noted here that the push button plunger assembly 39, 30, 37 is not normally in the illustrated position forcing push button spring reset bar 25 and its reset arm 26 against the switch assembly; this will be described later.) When the arm 10 has thus been moved away from supporting the switch assembly, the contact points 16S2 suddenly open the circuit to the clock

motor and the controlled device through switch blades 19 and 20, and suddenly close contact points 16S1, making an electrical circuit through switch blades 17 and 18 to complete a power circuit to a dark room lamp 47, an audible sounder or other indicating device 45. The device is then inactive from an interval timing standpoint.

To manually reset the device, the operator sets the dial wheel 5 back against friction clutch 3 to the number corresponding to the number of seconds in the interval required for the next operation that is to be timed, say, 8 seconds. This moves the pin 11 back to a position from which it will require 8 seconds to reach the switch release position of bar 10. The device is now set for 8 seconds. When it is desired that the interval shall start, the reset starting push button 54 for manual operation is pushed in, and its rearward plunger portion 37 strikes switch reset bar 25 moving it and its reset arm 26 out toward the switch combination and forcing insulating strip 14 far enough outwardly to permit spring 13 to pull switch release bar 10 against stop 12, in line with spring leaf 20 and insulator 14 of the spring switch combination. The push button 54 then returns to its rest position. This reset starting push button must, when required, reset the switch without positioning bar 28 and for this reason does not carry a full sized cam as do each of the other push buttons. Item 58 is a washer to aid in restraining spring 36, and must pass hole or opening 29 in the bar 28. This reset operation again closes switch points 16S2 and opens points 16S1. The clock motor will again run, and the power will be on the controlled circuit for the 8 second period until the pin 11 drives the switch release bar out of line with the switch combination thus relieving the tension on the spring blades and opening switch points 16S2 as before.

For the purpose of definition a "manual" as here used is a push button or lever, the single physical operation of which will start the disclosed devices upon their interval timing cycle. A "tappet" as defined by a dictionary most adequately describes the pin or protrusion 11.

The automatic push button portion of the instrument is mechanically connected to the time dial in such a manner as to retard this dial an amount equivalent to the time for which any particular button may be set up. The time dial, in response to the operation of any button, moves back to the automatic circuit initiating position from which it is driven by the clock motor. The amount of time for which the push buttons are set up for can be varied at will.

The automatic push button or single-operation portion of the device is supported in a frame composed of end members 42 and 43 and front and rear members number 40 and 41 respectively. This frame is mounted by multiple brackets 27 or other means. A treadle bar 28 is mounted by two end shafts 8 and 59 in holes in the frame and pieces 42 and 43. The extension of the treadle bar and shaft 8 carries switch release bar 10, spacing washer 9, and time dial 5. The latter, time dial 5, is rigidly mounted to treadle bar shaft 8.

In appropriately shaped holes in the front plate 40 and rear plate 41, are mounted push button plunger assemblies 30-37, each of which passes through an opening 29 in the treadle bar 28. The rear end 37 of each plunger is reduced in width up to the shoulder 30A, and is surrounded by a compression spring 36. A stop 60 on plunger 30 limits

the back stroke of the plunger upon striking the inside of frame front piece 40 under action of retaining spring 36. The front end of the plunger 30 is formed over to a right angle to form portion 38 which contains a hole to guide and clear screw 33. Extending through a slot 30B are two wedge locking members 31 and 32 each having a reduced midsection to fit the slot. In line with the clearance hole in 38 is a threaded hole in member 31 so that as screw 33 is turned within member 31, it pushes locking member 32 against the arcuate face of a semicircular actuating cam 34 which is pivotally mounted on the plunger 30 by a rivet assembly 35. The flat chordal edges of semicircular cam 34 comes to bear against the front face of the treadle bar, but on opposite sides of opening 29 and of the axis of rotation through 8 and 59. The screw 33 has an enlarged body 39 at the outer end to facilitate ease of adjustment without the aid of tools. In the outer end of each push button is a cavity 56 in which may be inserted a small tab indicating the number of units of time for which the cam 34 has been set and locked by locking clamp 32.

One of the push buttons in Fig. 1 is shown in the maximum depressed position and adjusted for almost the maximum time interval of the particular type of unit disclosed. The contact faces of cam 34 have positioned treadle bar 28 parallel to these faces, and in so doing time dial 5 has been backed up or reversed to a position that will require about 30 seconds for the clock motor to drive time dial 5 and its associated pin 11 back to a position in which it will actuate switch release bar 10. When the cam 34 has completely positioned treadle bar 28, it has reached its innermost position, and the small rear extension 37 will have contacted switch reset bar 25, which is tiltably mounted on fixed brackets 23 and 24. A spring 57 normally retains the reset bar against mechanical stop 24A, Fig. 1. Reset arm 26 is rigidly mounted to reset bar 25. In the position shown by this depressed button in Figure 1, reset arm 26, due to the action of end 37 on bar 25, has forced the switch combination into such a position that release bar 10 is pulled in line with switch leaf 20 and its insulator piece 14 and against stop 12; this also closes switch points 16S2, starting the motor 1 and controlled apparatus through blades 19 and 20, and opens contacts 16S1 in the circuit to the indicating means. Releasing the push button 39 allows reset arm 26 to come away from the switch combination, which is then held outwardly by the end of switch release bar 10.

After the 30 second period has elapsed, the trip pin 11 strikes release bar 10, forcing it away from the switch combination and allowing the switch points 16S2 to open suddenly, thus stopping motor 1 and shutting off the power to the controlled device, and closing points 16S1, thus starting the visual or audible means connected in this circuit.

The insulating pieces 14 and 15 in Figure 1, for insulating the electrical circuits from the mechanical part of the timer and case, is only one method of achieving such insulation. An alternative would be to make up the switch stack with five instead of four springs, and have the fifth spring insulated by additional stack spacers such as 21 and 15. In this case the switch release bar 10 and the reset arm 26 could operate directly on this added spring leaf without the insulation 14. More control circuits may also be added and other control functions performed by adding more leaf springs and contact points similar to 17, 18, 19, 20, 16S1 and 16S2.

To reset any button, the operation is to unscrew the push button and screw 33 to completely loosen the wedge locking members 31 and 32 so as to allow the cam 34 to be moved about its pivot 35. Time dial wheel 5 is then turned until indicia 7 on dial 6 indicates the time interval desired. The push button being set up is then depressed entirely and immediately allowed to return to its normal position under action of spring 36. The push button body 39 and screw 33 is then tightened to lock cam 34 into the position in which it has just been set by the manual positioning of time dial 5 and the attendant positioning of the treadle bar 28 during the time the push button was pushed in. Time dial wheel 5 is manually held in position until the push button has been released. There is a slight friction between cam 34 and the push bar 30 to hold the cam in place until the locking members are tightened.

If four buttons are set up for 5, 10, 20, and 40 seconds respectively, then by pressing the proper button, or by pressing various buttons successively after each preceding interval, any of the following total intervals may be secured: 5—10—15—20—25—30—35—40—45—50—55—60—65—70 and 75; that is, fifteen different total intervals may be secured with utmost ease without using any button more than once. This is an important contribution to the art.

If one wishes to have a time interval between those which might be set up on the push buttons, the manual dial may be used to set up the correct time interval desired. This will back trip pin 11 away from switch release bar 10, but the timer cannot start until the operator desires to have it start. When this moment arrives, the operator turns on the controlled apparatus by pushing the start button 54, which causes reset arm 26 to reset the switch into running position. At the end of the time interval the normal shut off occurs. This type of interval timer is also an important operating contribution because it simplifies operating procedures.

One reason for using the particular type of quick acting snap switch here disclosed, is that this spring blade type is very cheap. If the time dial projection pin 11 itself were allowed to open the switch by just being forced against it by the power of clock motor 1, the electrical switch gaps would be opened so very slowly that a great amount of point arcing would take place and burn the points out quickly; here, however, the points spring open so fast when the switch release bar 10 is forced away from under them that little sparking or arcing occurs. This is a distinct advantage of this type of switch.

It is not intended to infer that the time dial trip pin projection 11, or similar means, cannot act directly on a switch to perform the same function as here performed. Another, but more costly method is shown and described in connection with Fig. 9.

The same function can also be performed by allowing the time dial trip pin, or similar means, to operate a combination switch of the type disclosed in Figure 1, but which, instead of controlling the power circuits directly, may do so indirectly through electrical relays. This means that the combination spring blade switch then has to control only the relay coil current, which is small compared to the total lead current. This also is a more expensive method than Figure 1 and has the disadvantage that the time is in error by an amount depending upon the speed with which the push button is pushed; because

the circuits start functioning as soon as the trip pin is backed off from the trip position, and thus the time the interval circuit remains closed is longer than the measured time interval that the clock meter drives time dial 5. Now this does not happen to such an extent in the disclosure of Fig. 1, because the switch that starts the controlled circuit and clock motor action is not closed until the time dial 5 has been completely reset at the bottom of the push button stroke.

Figure 1 shows a colored filter glass window 48 in case 55 over a small light bulb 47. Lamp 47 is mounted in a standard light socket 46, or by other means, inside the instrument case. Within the case, most of the direct light is screened from the time dial scale 6 and time indicia 7, only enough light being permitted to pass to allow sufficiently clear vision to set up the dial. The light omitted through filter window 48 may have any characteristic desired for the particular application for which it is being used, this being controlled by changing the filter to the color desired. The switch 51, Figures 1 and 2, may be used to switch the dark room lamp 47 either to the power line 102, Figure 2, where it will remain on continuously, or to wire 105 and leaf 17 of the switch combination, where it will come on as a visual indicator at the end of the desired preset interval. In this manner this instrument can be used to take the place of a visual indicator after the time interval or as a filtered photographic dark room lamp. This also is a contribution to the art.

In Figures 1 and 2, switch 50 is provided to cut in the audible sounder or electric buzzer 45 to indicate the end of the desired time interval. If such signal is not needed, this switch can be thrown to the "off" position, disconnecting line 105 or 109 from line 107 to the buzzer. If it is desired to have the audible signal continue for the duration of the interval only, the switch 50 may be thrown to the terminal of wire 109.

If it should be desired to examine a negative or to perform some other operation with the controlled circuit when the disclosed apparatus is in the "off" position, the switch 52 in Figures 1 and 2 may be thrown to the "line" position connecting the controlled circuit direct to the line through lead 102, Figure 2. After such examination or other operation, preliminary to the interval check to follow, this switch 52 may be thrown to the "timer" position and connected to blade or leaf 19 of the combination switch through wire leads 108 and 109. This has a decided advantage, since no change has to be made in the controlled device, and its power plug does not have to be plugged in a continuous source. This is another distinct feature of the invention.

Switch 52B must be closed to connect terminal 20 and wire 102A to power wire 102 for normal operation, as above described. Opening this switch stops all timing action.

Figure 2 shows a diagram of electrical connections for the device. The power cord is shown as 53 and one side of the power circuit is common as lead 101 to one terminal of the clock motor 1, the lamp 47, the buzzer 45, and the controlled output socket 49. The other terminals of these parts are connected to their respective switches so that these individual parts or circuits can be connected either to the controlling mechanism or to the other side of the power line, as described.

Figure 9 shows an alternative control method using a special type of plunger switch 62. This

switch is of the quick snap type, and its operating members move only a few thousandths of an inch. One plunger operates a normally closed switch 62S2, and the remaining plunger operates a normally open switch 62S1. These switches perform identical circuit functions to those of the number 16S2 and 16S1 switches of Figures 1 and 2. Time dial setting wheel 5 in Figure 9 performs the same functions as in the previously described figures. On this dial wheel 5 is a perpendicular flange 61 which travel toward the plungers of switch 62 when the timer is running. When flange 61 strikes switch plungers 62S1 and 62S2, the S2 and S1 switches function the same as the corresponding switches in Figure 1, and the motor is stopped and the controlled circuit's function completed. The apparatus may be reset with the drum wheel 5 or by the push buttons as previously described.

Figures 7 and 8 show a toothed gear second-by-second spring clutch for use between dial wheel 5 and clock motor 1 in which the resetting or preselection is always in even second intervals. The toothed gear 64 is connected to the time driving motor, not shown, and a cooperating indexing spring 63 is fastened to dial wheel 5 of this and previous figures with rivets 63A. A protrusion 65 on spring 63 falls in between the teeth on 64 once for each unit of time, so that the preselections will be in even units of time depending upon the number of teeth in this gear.

On the time dial setting wheel 5, shown in Fig. 8, there is a notched indexing rim 5A, which may be applied to the devices of Figures 1, 3, 9 and 13 for the purpose of fingering this dial for resetting manually in the dark or in the light. If the fingering notches are some convenient number of units of time apart, then each time one is pulled down to some index point, which may be the end of the dial slot in the case, the device is reset for that many units of time.

If it is pulled down some multiple of these notches, then the total time interval will be the addition of these operations; as an example, if the notches 5A extending through the case of the device are 10 seconds apart and two pulls are made before starting the time interval, then the total time interval will be 20 seconds. This resetting operation can be performed in total darkness or without seeing the device. This is a distinct advantage.

An additional single button means of selecting a variable or constant time interval, by suitably retarding dial 5, is shown in Figures 5 and 6. This could replace the multiple push buttons of Figure 1. The setting of the adjustable stop 121 is varied to produce different length plunger strokes by adjusting and operating knob 118. This allows pawl 116 to engage ratchet wheel 115, which is integral with time setting dial 5. Wheels 115 and 5 will then be turned an amount determined by the length of stroke of plunger 120 and adjustable stop 121. Spring 124 returns the plunger to the "out" position, that is toward the left in Figure 5 where stop 117 holds pawls 116 off of ratchet wheel 115 and teeth 115A. At the extreme of this "out" position of plunger 120, a stop 120E is engaged at the front supporting frame 122. When the plunger 120 and the pawl 116 are in the normal position, to the left, the pawl is prevented from engaging teeth 115A by stop 117. Stop 117 prevents pawl 116 from falling low enough to engage the teeth in this normal position. The motor then returns wheels 5 and 115 to the zero position where pin 11 stops

the device in the manner previously described. The position of the adjustable stop 121 is controlled by turning the knob 118 and its associated threaded portion 119. The plunger is supported between two frame members 122 and 123. Stop 123A is an integral portion of rear frame member 123.

In addition to the single push button type just described in connection with Figure 5, it is to be noted that another very practical variation would be to have a lever swinging about shaft 8 and carrying a pawl similar to pawl 116 in Figure 5 so that each time the lever is pulled down the wheel 115 and dial 5 would be retarded by an amount depending upon how far the lever was pressed down. This distance could be determined by the length of the slot in the case through which the lever extended. This lever, operating through an arc, would be returned to its normal position by a spring so that the ratchet could also be returned to an inactive position, allowing the clock motor to return the dial wheel to the control point. For fully automatic operation, this lever could reset such a switch combination as that associated with the dial wheel in Figure 1 and Figure 4.

Figures 10 and 11 show another single push button method of presetting the time interval drum 5 and which may be substituted for the multiple push button assembly of Figure 1. Here a toothed wheel 79 is connected to the time interval wheel 5. A push button plunger 74 carries several pins 76 about its body 75, each of which pins is at a different distance from the end of plunger. If the plunger 74 is turned so as to have one pin 76 engage a tooth 78 on wheel 79, and then pushed in the full length of its stroke, the wheel 79 will be advanced an amount depending on which pin was engaged. Then if the plunger 74 is turned so that no pin engages the wheel, as shown in Figure 11, and allowed to return to its normal position, the wheel 79 and time drum wheel 5 can be returned to the controlling position by the clock motor as previously described. A keyed detent arm 71 carrying a detent index point 70 positioned by a key slot 67 is used to indicate which pin 76 will engage wheel teeth 78. Spring 68 serves to return the push button plunger to its normal position after the selected pin 76 has engaged teeth 78 and rotated wheel 79 the desired amount.

Figures 12 and 13 show my interval timer in its simplest form. The motor 1 is mounted to the case by bracket 81 and has an output shaft 2 driving dial 83, hub 87 and knob 88 by friction between this shaft and hub 87. Hub 87 carries a switch release bar 87B retained toward a fixed stop 86 in slot 87A by the spring 85 so that when start button 80 is pushed down, the insulating member 90 on the end of this release bar will be brought into the return path of the switch blade 91. In this position, the clock motor and controlled circuit plug 95 are connected to the power system through lead 112, blade 91, switch points 92S, blade 93 and lead 111. Time dial 83 carries a pin 84 which, after the interval time has elapsed, strikes switch release bar 87B and forces insulating member 90 away from switch blade 91, causing contacts 92S to spring open to break the controlled circuit, as before described. The dial can be reset to some desired time interval as indicated by indicia on same, because it is friction driven by the motor shaft 2. The motor 1 does not start, nor does the controlled circuit 95 receive power from lines 110 and 111, until

push button 80 is pressed down and switch release bar 87B is pulled back to hold switch contacts 92S closed for the interval.

Push button 80 is guided by brackets 89 and insulated from switch 92S by insulator 80A. The push button return spring 91A could obviously extend under switch release bar 87B and itself insulated from switch 92S if desired. Insulating and extending this spring 91A could eliminate parts 80A and 90, in which case the release bar would be made as long as the illustrated release bar and part 90 combined. The apparatus is enclosed by any suitable enclosure 82.

The notched time dial 5 and 5A as shown in Figures 7 and 8 is applicable to each of the devices shown or discussed, so that for manual operation either odd intervals, as indicated by the dial indicia 7, or even intervals, depending upon the distance between the notches 5A and the length of the time dial slot in the case 55 can be obtained. For manual operation, the switch combination must be manually set at the start of the desired interval, as indicated for Figures 12 and 13.

These disclosures preceding presuppose the use of a self-starting clock motor which starts when the voltage of the source is connected to it. This condition, however, is not necessary, because the manual start button or element may also mechanically operate the starting element of a non-self-starting clock motor.

For this type of starting, see Fig. 16 where the interval starting button 138 carries a protrusion 138A. This protrusion 138A is in the path of a protrusion 137A on the motor starting arm 137, which is restrained in the position shown by a tension spring 140. Motor starting arm 137 is pivoted on the pivot pin 141, attached to the case 138. The other end of starting arm 137 lies in the path of the manual starting lever 136 of the non-self-starting clock motor 135. The unit is otherwise similar to those shown in Fig. 13 or Fig. 1, where the manual interval starting button 80 and starting and reset arm 26, respectively, perform the same function as the starting and reset button 138 of this Fig. 16 being described. When this start button 138 is pressed, the motor start lever 136 is momentarily forced down toward the dotted starting position 136A. The motor 135 is held positioned by motor bracket 81 fastened to case 138. Motor bracket 81 carries a retaining clip 89 which guides the start push button as previously described. The motor 135 is stopped in the normal manner described for Fig. 1 and Fig. 3 when switch release pin 11, driven by the clock, drives switch release bar 10 away from the switching means so as to allow a very quick opening of the switch.

There is no intention of limiting the multiple push button mechanism for interval reset or interval start to that particular treadle bar type shown in Fig. 1. The use of any type of push button mechanism that is adaptable to allow the push buttons to operate the reset bar 25, or perform a similar function, is contemplated.

Fig. 14 shows a lever operated interval timer which may be reset to a desired interval in the dark by the sense of touch. This is a variation of the device shown in Fig. 5. The functions of ratchet wheel 115 of this Fig. 14 are the same as 115 in Fig. 5. In Fig. 14, the push lever 117B carries a push button 118A and a pawl 116A pivoted at pin 121A. The pawl is held in contact with ratchet teeth 115A by a spring 119A, one end of which is secured to the lever 117B. A keeper

spring 115B retains lever 117B in a normal position such that the pawl face 116B bears against a limit stop 114. Tension spring 115B is fastened in a hole 117C in the lever and on a fixed pin 113 in the timer case 124A. The slope of pawl face 116B is such that when it strikes stop pin 114, the ratchet engagement tooth 122A is forced out of the path of the ratchet gear teeth 115A, so that the ratchet wheel may be turned by the clock motor. Spring 115B is stronger than spring 119A, and as the former spring raises lever 117B, causing pin 114 to be engaged by cam surface 116B of the pawl, the pawl is forced by pin 114 to turn in a clockwise direction until its lower surface 116C strikes stop-pin 120B on the lever. This prevents further clockwise motion of the pawl, which, in turn, prevents the further upward movement of the lever under action of keeper spring 115B. When the lever 117B is pushed down, pawl tooth 122A engages ratchet teeth 115A and the wheel 115 is turned in a direction opposite to that indicated by the arrow by an amount depending on the stroke of the downward push. The lever is limited in downward movement by an adjustable stop 124C in one of several holes 124B in the edge of case 124A. Thus, if the angle through which wheel 115 is pushed back by the operation of lever 117B (for a particular position of stop pin 124C), is equal to the angle through which the wheel moves—5 seconds, the timer will be set for this interval, and when the manual interval start button (as shown on any of the other figures) is pressed, the controlled interval will be 5 seconds. If the lever 117B is pressed 3 times before the interval start button is pressed, then the controlled interval will be 15 seconds. The action of the switch release pin 11 of Fig. 14, performs the same function as pin 11 in Figs. 1 to 10.

Fig. 15 shows a mechanically stopped interval timer for either a mechanical spring wound or an electrical clock motor. The time drum 128 and switch release pin 11 perform the same functions as previously described. The interval start button or lever 126 performs the function of forcing switch 16S—2 and 16S—1 radially outward or away from the shaft 8 so that the switch release bar 10 may fall into the position shown. In this position the switch 16S—2 is closed, supplying energy to the motor or to an external load, as described in connection with previous figures. In addition, when this bar 10 is holding the switch blade 20 out in the position shown, an extension 20A is held away from the time governing escapement 132, or other low power part, of the clock system. When the clock has driven the time dial 128 and switch release pin 11 in the direction of the arrow until this pin 11 moves the switch release bar 10 upward, allowing the switch blade 20 to quickly spring axially in toward the shaft 8, it will be noted that the switch blade extension 20A strikes part 132 of the clock mechanism and stops the clock. After the release pin 11 has been manually set back an amount corresponding to the next desired interval, the clock will not start until the start button or lever 126 has been pushed to force the switch blade 20 outward radially and allow the release bar to fall down in line with the switch as shown in Fig. 15, and in this position the extension 20A is held away from the time governing spring 132. When 20A is in this position, the clock will run because there is no braking action on the timing means.

It is obvious that the clock motor starting fea-

ture of Fig. 16 and the brake stopping method shown in Fig. 15 may be combined in a single unit if so desired.

While specific forms of construction have been shown and described, it is to be noted that there are many variations and changes which can be made in differing combinations for different requirements, and that these modifications are contemplated as coming within the scope of the following claims.

What I claim is:

1. An interval timer including in combination, a supporting frame; a movable indicator of time periods; a projection positively movable with said indicator; a motor; friction means operatively connecting said motor and indicator; interrupting instrumentalities mounted on said frame and comprising switching means acting in a first position to open the circuit to said motor and to close the circuit to an external device, and in a second position to close the circuit to said motor and to open the circuit to said device; yielding means for holding said switching means in said first position; starting means for moving said switching means from said first position to said second position; and a movable release member adapted to lock said switching means in said second position and acting upon engagement and movement by said projection to release said switching means to permit it to return to said first position.

2. An interval timer including: a movable indicator of time periods; a constant speed motor for driving said indicator; a tappet projection positively movable with said indicator; terminals for connection to an external device to be controlled; stationary switching means comprising a movable portion yieldably held in a first position; starting means for moving said portion to a second position; and a movable release member adapted to lock said movable portion in said second position, and acting upon engagement and movement by said tappet to release said movable portion; one of said terminals so connected to said switching means that a circuit is completed to said terminal when said movable portion is in one of said positions; and said motor so connected to said switching means that a circuit is completed to said motor when said portion is in said second position.

3. An interval timer including: a movable indicator of time periods; a motor for driving said indicator and having a starting element; a tappet projection positively movable with said indicator; stationary switching means comprising a movable portion yieldably held in a first position; a manual actuator for moving said portion to a second position and for operating said element to start said motor; and a movable release member adapted to lock said movable portion in said second position and acting upon engagement and movement by said tappet to release said movable portion; said motor so connected electrically to said switching means that the circuit is broken when said portion is in said first position.

4. An interval timer including: a movable indicator of time periods; a motor; friction means operatively connecting said motor and indicator; electrical terminals for connection to an external device to be controlled; electrical switching means comprising a member movable to a first control position in response to the movement of said indicator to a stop position, and capable of occupying a second control position when said indicator is moved away from said

stop position; one of said terminals so connected electrically to said switching means that a circuit is completed to said terminal when said member is in one of said control positions; said motor so connected electrically to said switching means that a circuit is completed to said motor when said member is in said second control position; a plurality of push buttons for moving said indicator away from said stop position; and adjustable means operatively associated with said plurality of push buttons for determining how far from said stop position said indicator will move upon operation of said plurality of push buttons.

5. An interval timer including: a movable indicator of time periods; a motor for driving said indicator; electrical terminals for connection to an external device to be controlled; electrical switching means comprising a member movable to a first control position in response to the movement of said indicator to a stop position, and capable of occupying a second control position when said indicator is moved away from said stop position; one of said terminals so electrically connected to said switching means that a circuit is completed to said terminal when said member is in one of said control positions; said motor so connected electrically to said switching means that a circuit is completed to said motor when said member is in said second control position; a plurality of push buttons; and adjustable means operatively interposed between said plurality of push buttons and said indicator and acting upon operation of said plurality of push buttons to move said indicator away from said stop position to a position predetermined by the adjustment of said adjustable means.

6. An interval timer comprising a time indicator having a time stop setting and movable away from said stop setting to off-normal settings respectively designating different time periods, a plurality of manuals respectively corresponding to different time periods and each operable from a normal position to an off-normal position, means selectively controlled by the selective operation of said manuals for moving said indicator to off-normal settings respectively corresponding to the manuals which are operated, motor means for moving said indicator back to its normal setting from any off-normal setting to which it is moved, means responsive to the operation of any one of said manuals to its off-normal position for rendering said motor operative to drive said indicator, and control means operative to one setting in response to operation of said last-named means and to a different setting in response to movement of said indicator back to its normal setting.

7. An interval timer comprising a time indicator having a time stop setting and movable away from said time stop setting to off-normal settings respectively designating different time periods, a plurality of manually operable elements respectively corresponding to different time periods and each operable from a normal position to an off-normal position, means biasing said elements to their respective normal positions, an indicator actuating member common to said elements and disposed in the paths of movement thereof to be operated to different settings in response to operation of different ones of said elements, means including said actuating member for selectively moving said indicator to the off-normal settings corresponding to the manuals which are operated, motor means for moving said

indicator back to its normal setting from any off-normal setting to which it is moved, means common to said elements and responsive to operation of any one thereof to its off-normal position for rendering said motor operative to drive said indicator, and control means operative to one setting in response to operation of said last-named means and to a different setting in response to movement of said indicator back to its normal setting.

8. An interval timer comprising a time indicator having a time stop setting and movable away from said stop setting to off-normal settings respectively designating different time intervals, a motor for moving said indicator from any off-normal setting back to said stop setting, a plurality of manuals selectively operable to move said indicator to different settings away from said stop setting, means for rendering said motor operative to move said indicator back to said stop setting, and control means operative to one setting in response to operation of said last-named means and to a different setting in response to movement of said indicator back to its stop setting.

9. An interval timer comprising a time indicator having a time stop setting and movable away from said stop setting to off-normal settings respectively designating different time intervals, a motor for driving said indicator from an off-normal setting back to said stop setting, a plurality of elongated manuals selectively operable to move said indicator to different settings away from said stop setting, means movably supporting said manuals in positions substantially parallel to each other, a movable member extending transversely of said manuals in the paths of movement thereof to be actuated in response to the operation of any one of said manuals, means responsive to actuation of said member for rendering said motor operative to drive said indicator, control means operative to one setting in response to operation of said member, and means including a part movable with said indicator for operating said control means to a different setting in response to movement of said indicator back to said stop setting.

10. An interval timer comprising a time indicator having a time stop setting and movable away from said stop setting to off-normal settings respectively designating different time intervals, a motor for driving said indicator from an off-normal setting back to said stop setting, a plurality of elongated manuals respectively corresponding to different off-normal settings of said indicator, means movably supporting said manuals in positions substantially parallel to each other, a first movable member extending transversely of said manuals in the paths of movement thereof to actuate said indicator to said different off-normal settings in response to the selective operation of said manuals, a second movable member extending transversely of said manuals in the paths of movement thereof to be actuated in response to the operation of any one of said members, means responsive to the actuation of said second member for rendering said motor operative to drive said indicator, control means operative to one setting in response to operation of said member, and means including a part movable with said indicator for operating said control means to a different setting in response to movement of said indicator back to said stop setting.

11. An interval timer comprising a time indi-

cator having a time stop setting and manually movable away from said stop setting to off-normal settings respectively designating different time intervals, a motor for moving said indicator from any off-normal setting back to said time stop setting, a manual operable to move said indicator to a predetermined off-normal setting away from said stop setting, a second movable manual non-operatively associated with said indicator, means responsive to the operation of either of said manuals for rendering said motor operative to drive said indicator, control means operative to one setting in response to operation of either of said manuals, and means including a part movable with said indicator for operating said control means to a different setting in response to movement of said indicator back to its stop setting.

12. An interval timer comprising a time indicator having a time stop setting and manually movable away from said stop setting to any one of a plurality of off-normal settings respectively designating different time intervals, a motor for moving said indicator from any off-normal setting back to said stop setting, a manually operable element biased to one position and movable to a second position, adjustable means movable by said manual and operative to move said indicator to a predetermined off-normal setting determined by the adjustment thereof, means including a part engaged by said manual during operation thereof to actuate said adjustable means for rendering said motor operative to drive said indicator, control means operative to one setting in response to operation of said manual, and means including a part movable with said indicator for operating said control means to a different setting in response to movement of said indicator back to its stop setting.

13. An interval timer comprising a time indicator having a time stop setting and movable away from said stop setting to off-normal settings respectively designating different time intervals, a manual operable in two directions, actuating means responsive to movement of said manual in one direction to select different off-normal settings of said indicator and responsive to operation of said manual in a different direction to move said indicator to the selected off-normal setting, motor means for moving said indicator from any selected off-normal setting back to said stop setting, and control means operative to one setting in response to operation of said

actuating means and to a different setting in response to movement of said indicator back to said stop setting.

14. An interval timer comprising a rotatable time indicator having a time stop setting and manually rotatable away from said time stop setting to different off-normal angular settings respectively designating different time intervals, a pivotally supported control arm biased to a latching position and pivotally movable to a release position, a control element latched by said arm in one position and biased to move to a second position for latching said arm in its release position when said arm is moved to its release position, motor means for rotating said indicator from any off-normal setting thereof back to said stop setting, means carried by said indicator for engaging said arm to move said arm to its release position in response to rotation of said indicator back to its stop setting, manually operable means for moving said element from its second position to its one position, thereby to release said arm for return to its latching position, and control means operative in response to movement of said element between its two positions.

15. An interval timer comprising a rotatable time indicator having a time stop setting and manually rotatable away from said time stop setting to different off-normal angular settings respectively designating different time intervals, a pivotally supported control arm biased to a latching position and pivotally movable to a release position, a control element latched by said arm in one position and biased to move to a second position for latching said arm in its release position when said arm is moved to its release position, motor means for rotating said indicator from any off-normal setting thereof back to said stop setting, means carried by said indicator for engaging said arm to move said arm to its release position in response to rotation of said indicator back to its stop setting, a manually operable element operative to rotate said indicator from its stop setting to a predetermined off-normal setting, means responsive to operation of said manually operable element for moving said control element from its second position to its one position, thereby to release said arm for return to its latching position, and control means operative in response to movement of said element between its two positions.

LLOYD P. MORRIS.