Oct. 10, 1950 E. E. SPRINGER 2,525,464

TIME EXPOSURE INDICATOR FOR SUN LAMPS

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Fig. 2.

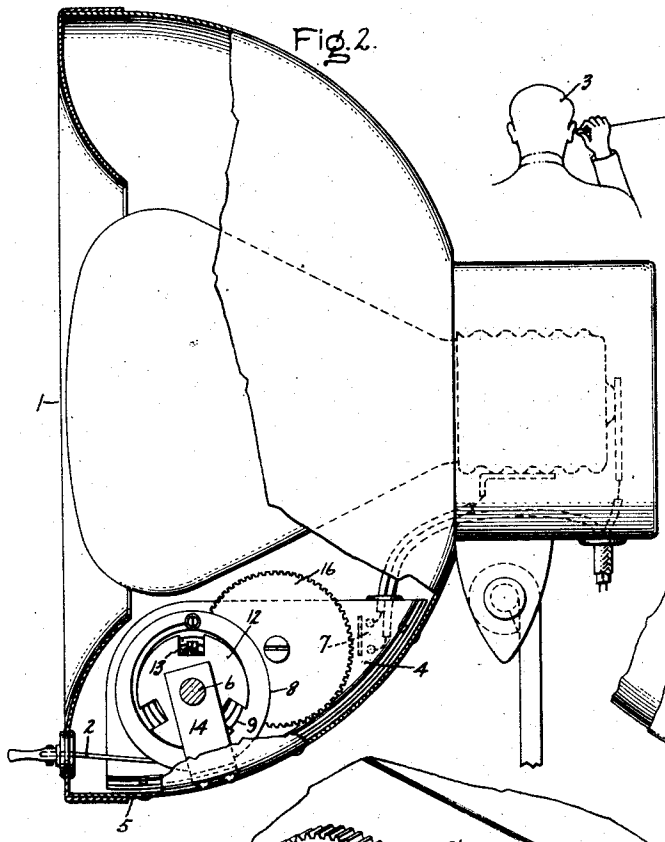


Fig. 1.

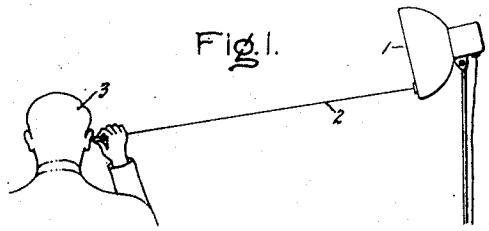


Fig. 3.

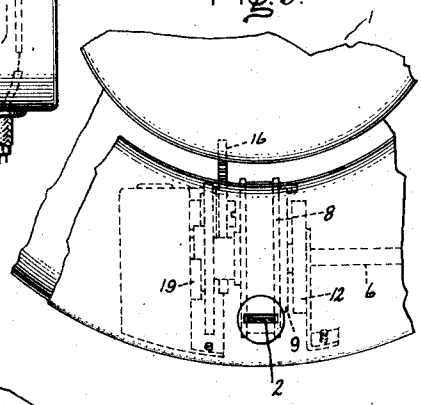
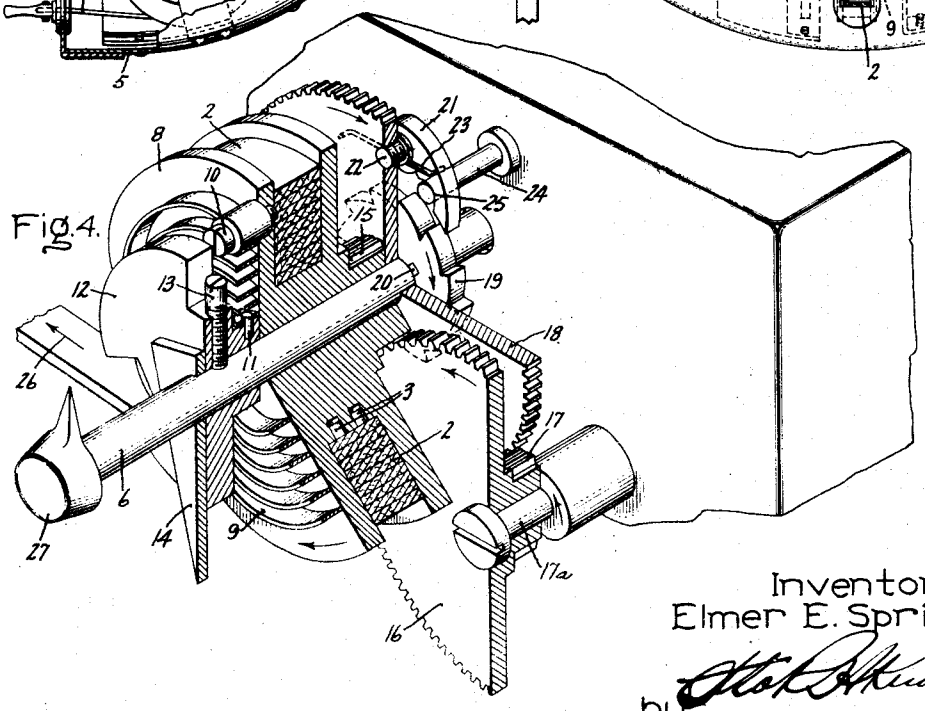


Fig. 4.



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Fig. 5.

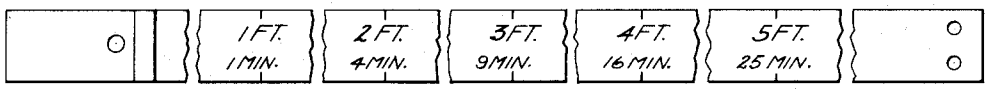


Fig. 6.

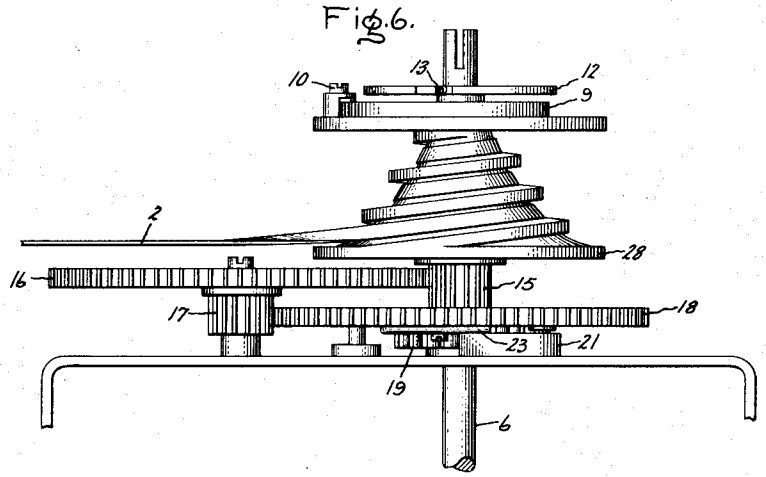
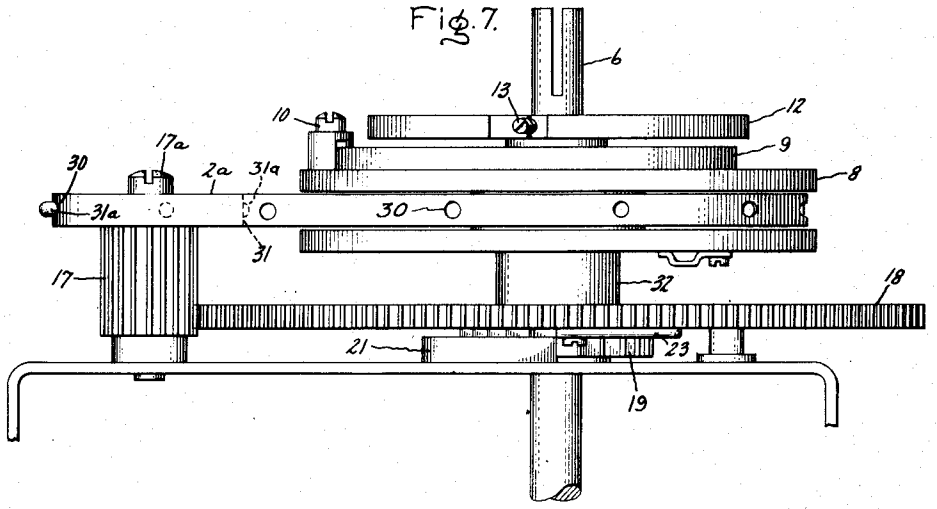


Fig. 7.



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TIME EXPOSURE INDICATOR FOR SUN LAMPS

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12 Claims. (Cl. 250—95)

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The present invention relates to an exposure indicator and control device especially for sunlamps or the like.

In the use of sunlamps, X-ray machines and other sources of radiant energy, the duration of exposure of a surface such as the human body to the radiations is often critical; that is, an exposure which exceeds a certain maximum may be harmful rather than beneficial. Moreover, the time duration of a safe exposure usually varies with the distance of the body from the source of radiations. For example, in the use of a sunlamp producing certain ultra-violet radiations it is known that a given degree of erythema will be produced in a given time at a given distance from a particular lamp. However, since it is not always convenient to maintain exactly the same distance from the lamp, the time required to produce a given erythema will vary with the distance of the body from the lamp. Likewise, the safe maximum exposure will vary with this distance. Moreover, since sunlamps are relatively low power sources of ultra-violet radiation, it is necessary to use them very close to the body. Small variations of distance, therefore, produce relatively large variations in the safe exposure time. To complicate the matter further, the variation of exposure time with distance is not a simple proportion but follows a square law; that is, the maximum safe exposure time increases as the square of the distance from the sunlamp.

It is an object of my invention to provide an indicating device whereby the user of a sunlamp or a similar source of radiant energy can obtain, without calculation, an automatic indication of the safe exposure time for any distance at which he may place himself from the lamp.

It is a further object of my invention to provide a timing mechanism which will automatically turn off the lamp after the expiration of the safe maximum exposure time for any selected distance from the lamp to the user.

The above and other objects of the invention as well as the manner of carrying out the same will best be understood from the following description taken in connection with the accompanying drawings in which Fig. 1 is a diagrammatic representation of a person using a sunlamp equipped with my invention; Fig. 2 is an elevation partly in section of a sunlamp mounted in a reflector and incorporating a modification of my invention; Fig. 3 is a front elevation of the timing mechanism portion of Fig. 2; Fig. 4 is a perspective view partly in section of the timing

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mechanism portion of Fig. 2; Fig. 5 is a representation of portions of an exposure time indicating tape measure; Fig. 6 is an elevation of a modification of my invention; and Fig. 7 is an elevation of a further modification.

The simplest form of my invention is illustrated in use in Fig. 1. A sunlamp 1 or other source of radiations has mounted beside or within its reflector, a flexible tape measure 2 which can be extended from the reflector toward the body of a sunlamp user 3. The tape 2 is preferably coiled within the reflector with a steel spring rewind mechanism or in some cases the tape itself may be made of suitably formed spring steel which will automatically rewind itself when released. The exit edge of the tape holder may act as a pointer. These types of mechanisms are well known in the art of measuring tapes.

According to my invention, however, the tape 2 is calibrated in terms of safe maximum exposure time, as in the example illustrated in Fig. 5. If desired, simple distance calibrations may also appear on the tape. It will be observed that the time exposure calibrations are not arranged in a simple proportional relation to the distance the tape is extended, but are arranged in proportion to the square of the distance the tape is extended; for example, if the safe maximum exposure at one foot from the lamp is one minute, the safe exposure at two feet from the lamp will be four minutes, at five feet, 25 minutes, etc.

It will be evident to those skilled in the art that the tape can also be arranged in other ways. For example, the tape 2 of Fig. 1 wound on a reel mounted within the bezel of the lamp fixture may have its free end passed over a pulley and attached to the lamp fixture. The pulley may be provided with means for grasping it whereby it may be extended to the surface to be irradiated. In this way, a double length of tape is extended from the lamp to the surface. The exposure time and distance calibrations can then be suitably arranged on the tape so that the exposure time and distance can be read off at the pulley rather than at the lamp fixture, the time indicia being arranged in proportion to the square of the distance of extension of the tape, that is the distance from the surface to the lamp fixture.

Another suitable arrangement for producing an indication of the suitable exposure time is to have the retractable tape (or a cord may be substituted) suitably coupled to a dial with a cooperating pointer. Time and distance calibrations may then be provided on the dial with the

time indicating indicia suitably spaced around the dial in proportion to the square of the distance of extension of the tape or cord from the lamp or other source of radiant energy to the surface to be irradiated.

According to a further feature of my invention, the measuring tape can be arranged to set an appropriate timing device to the proper safe exposure time merely by pulling the tape out to the position occupied by the sun lamp user. A suitable timing device is one which is provided with contacts which can be connected in circuit with the lamp and which contacts are closed when the timing device is started by turning its control shaft from its "off" position to some other position, whereupon the motor of the timing device will return the control shaft to its initial position and thereby open the contacts after a time dependent upon the degree of rotation given to the control shaft. The timing device motor may be operated by energy stored in a spring when the control shaft is set, or it may be an electrically operated clock motor. Many devices of this kind are well known in the art.

A mechanism for carrying out this feature of my invention is illustrated in Figures 2, 3 and 4. A suitable timing device 4 is mounted within the housing of reflector 5 within which a sunlamp 1 is supported in a suitable socket which connects the lamp to a power source and to the timer contacts. The timer 4 is provided with contacts 7 which are normally open, but which are closed when the control shaft 6 of the timer is rotated from its "off" position in a clockwise direction as viewed in Fig. 4. The contacts 7 are opened by the counterclockwise rotation of the shaft 6 to its initial or "off" position by the timing device motor. To bring about the proper setting of the shaft 6 and thereby maintain the contacts 7 closed for the desired exposure time in accordance with the distance of the sunlamp user, I provide a mechanism which is operated by the tape 2 when it is extended by the operator and released.

The tape 2 is wound on a spool 8, one end of the tape being fastened to the spool in any suitable manner, for example, by means of the drive pins 3. The spool 8, as viewed in Figs. 2 and 4, is tensioned in a counterclockwise direction by a coil spring 9, the outer end of which is fastened to the spool in some suitable manner, as by means of the screw 10. The inner end of the spring 9 is fastened by means of a pin 11 to a disc 12, which in turn is secured to the shaft 6 by means of a set screw 13. The outer end of the shaft 6 may be supported in any suitable bearing such as may be provided, for example, by the bracket 14. The opposite end of the spool 8 is provided with a spur gear 15 which meshes with an idler gear 16. The gear 16 carries another spur gear 17, both of these being journalled on a stub shaft 17a mounted on the side wall of the timing device 4. Gear 17 in turn meshes with another gear 18 centered on the shaft 6. Both the spool 8 and the gears 15 and 18 are free to turn on this shaft. A ratchet 19 is secured to the shaft 6 by means of a key 20 so that it rotates with the shaft. A pawl 21 is mounted on a pivot 22 threaded into the gear 18. A spring 23 tensions the pawl toward the ratchet 19. In the zero or "off" position of the timing device shaft 6, as illustrated, the pawl 21 is held out of engagement with the ratchet by the pawl stop 24 which may be mounted as shown on the wall of the timing device 4. The stop 24 engages a curved notch 25 cut in the bottom edge of the pawl.

The operation of the mechanism is as follows: When the tape 2 is pulled in the direction of the arrow 26, it will cause the spool 8 to rotate in a clockwise direction, thereby increasingly winding up the spring 9. As the spool 8 turns, gears 16 and 17 are rotated in the opposite or counterclockwise direction, causing the gear 18 to turn clockwise. Gear 18 carries with it the pawl 21, causing the latter to leave its stop 24 and to engage a tooth of the ratchet 19. The shaft 6 is thereby turned in a clockwise direction, closing contacts 7 and setting the timing device.

When the tape has been withdrawn by the sunlamp user to the point where the end of the tape just touches the side of his body nearest the lamp, as illustrated for example in Fig. 1, the shaft 6 will have been rotated and the timer will have been set to give the desired maximum safe exposure time for the particular distance of the user from the lamp. The user then releases the tape, permitting the tape to be rewound on the spool 8 by the spring 9 by means of the tension built up in the spring when the tape was withdrawn, this tension being the difference in total rotation between the spool 8 and the shaft 6. As the tape is rewound, gear 18 turns counterclockwise, allowing the pawl 21 to slip over the ratchet 19 until it is engaged by the pawl stop 25. The timer 4 then operates to rotate the shaft 6 counterclockwise until it reaches its initial or "off" position and the lamp circuit is deenergized.

It will be observed that in this modification I use a rather thick tape. This is necessary in order to provide substantially the desired increase in the number of degrees of rotation of the shaft 6 in accordance with the square of the linear distance of extension of the tape. This desired result is obtained by suitably proportioning the thickness of the tape to the diameter of the spool 8. The gear train merely acts to give a proportional decrease in the amount of rotation of the shaft 6 compared to that of the spool 8 as may be required by the characteristics of the timing device 4.

It will be observed that my automatic timer setting mechanism does not in any way interfere with manual setting of the timer. For this purpose, a suitable operating knob 27 may be secured to either end of the shaft 6 and, if desired, the operating knob may carry a pointer cooperating with a scale (not shown) calibrated in minutes in the customary manner.

A modification of my invention is shown in Fig. 6. In this modification a tape 2, which need not have any special thickness, is wound upon a spirally grooved conical drum 28. The diameters of the successive turns of the spiral are chosen to give the desired increase in the total number of degrees of rotation of the pulley 28 and the timer shaft 6 in proportion to the square of the distance by which the tape 2 is extended. The other elements of this modification are substantially the same as in Figs. 2, 3, and 4, and have been given the same reference numerals. It may be noted that in this modification a flexible nonelastic cord, such as a cord with a wire center may be substituted for the tape where time and distance indications, as in Fig. 5, are not desired.

A further modification of my invention is illustrated in Fig. 7. In this modification the tape 2a, of any convenient thickness, is perforated as indicated at 30, the perforations being

spaced at suitable intervals as will presently appear. The tape 2a is wound on a simple spring-tensioned spool 8 similar to the spool shown in the first modification. However, in leaving the spool 8, the tape 2a passes over a sprocket wheel 31 which replaces gears 15 and 16 of Fig. 4. The sprocket wheel 31 has secured to it the spur gear 17 meshing with gear 18 carrying the pawl 21 as in the modification of Fig. 4. In Fig. 7 the spool 8, loosely mounted on the shaft 6, is spaced from the gear 18 by a spacer or collar 32. The sprocket wheel 31 has four equally spaced teeth 31a. The tape 2a encircles the sprocket wheel just enough less than one-quarter of a turn to permit the tape to clear two adjacent teeth so that the unperforated portions of the tape can slip over the sprocket wheel 31. There is, however, sufficient friction between the tape and the edge surface of the sprocket wheel to tend to rotate the wheel when the tape is withdrawn to measure the distance of the sunlamp user from the sunlamp. Thus, when one of the perforations 30 reaches the sprocket wheel, the wheel will turn under friction sufficiently to permit a sprocket tooth 31a to be engaged by the perforation. As the tape is further withdrawn, the tape will then rotate the sprocket wheel one quarter of a turn whereby another sprocket 31a will be brought into position to engage the next perforation. The perforations 30 are spaced along the tape in accordance with the desired square law relationship by the linear motion of the tape and the rotation of the sprocket and timer shaft. The perforations are, therefore, closer together as they extend away from the end of the tape. Thus, as the tape is withdrawn, a smaller extension of the tape produces a greater degree of rotation of the shaft 6 and a consequent increase in the exposure time setting of the timer 4.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An exposure indicator for a radiant energy source of given intensity comprising a spring tensioned tape adapted to be mounted on a lamp support and having a portion of the tape extensible from the support to a surface to be irradiated by a lamp in said support, said tape having indicia thereon representing safe exposure time calibrations arranged in order of the square of the distance of extension of said tape portion from the lamp.

2. An exposure indicator for a radiant energy source of given intensity comprising in combination with a lamp support, a spring tensioned spool rotatably mounted thereon, a flexible tape wound on said spool and having one end fixed thereto whereby the tape can be extended from the lamp support, and indicia on said tape representing safe exposure time calibrations arranged in order of the square of distance from the other end of said tape.

3. An exposure indicator for a sunlamp comprising in combination, a reflector, a lampholder mounted within said reflector and adapted to receive a lamp, a spring tensioned spool rotatably mounted within said reflector, a flexible tape wound on said spool and having one end fixed thereto, said reflector having an aperture in the front thereof providing an exit for the other end of said tape whereby the tape can be extended from the lamp to a surface to be irradiated, and indicia on said tape representing time calibrations arranged in order of the square of distance from said other end of the tape.

4. A device for controlling a source of radiant energy, comprising a flexible tape adapted to be progressively extended from said source toward a surface to be irradiated and means including a switch controlled by extension of said tape for deenergizing said source after a time interval proportional to the square of the distance of extension of said tape.

5. A device for controlling a source of radiant energy, comprising a support for said source, a time controlled switch for energizing and de-energizing said source, and means for controlling the energization interval including a spring tensioned flexible tape extensibly mounted on said support for extension therefrom to a surface to be irradiated and a mechanism interconnecting said tape with said swtch.

6. A device for controlling a source of radiant energy comprising a support for said source, a time controlled switch having contacts connected in circuit with said source and having a control member adapted when actuated to close said contacts and to open the same after a time interval proportional to the degree of actuation of said member, a flexible tape adapted to be progressively extended from said support toward a surface to be irradiated and a mechanism interconnecting said tape with said member for actuating said member by extension of said tape in proportion to the square of the distance of extension of said tape.

7. A device for controlling a source of radiant energy comprising a rotatably mounted spool, a tape extensibly wound on said spool so that unwinding of the tape rotates the spool, the degree of rotation of the spool varying substantially as the square of the length of tape unwound, a time controlled switch connected in circuit with said source and having a rotatable control member for setting the switch and means mechanically interconnecting said spool and said control member for rotating said member in direct proportion to rotation of said spool in response to unwinding of said tape.

8. A device for controlling a source of radiant energy comprising a rotatably mounted spool, a tape extensibly wound on said spool so that unwinding of the tape rotates the spool, the degree of rotation of the spool varying substantially as the square of the length of tape unwound, a time controlled switch connected in circuit with said source and having a rotatable control member for setting the switch, means mechanically interconnecting said spool and said control member for rotating said member in direct proportion to rotation of said spool in response to unwinding of said tape, and spring means for rewinding said tape on said spool.

9. A device for controlling a source of radiant energy comprising a rotatably mounted spool, a tape extensibly wound on said spool so that unwinding of the tape rotates the spool, the degree of rotation of the spool varying substantially as the square of the length of tape unwound, a time controlled switch connected in circuit with said source and having a rotatable control member for setting the switch, means mechanically interconnecting said spool and said control member for rotating said member in direct proportion to rotation of said spool in response to unwinding of said tape, said means including a ratchet secured to said member, an element rotatable with said spool and a pawl carried by said element and adapted to engage said ratchet for rotating the same.

10. A device for controlling a source of radiant

energy comprising a rotatably mounted spool, a tape extensibly wound on said spool so that unwinding of the tape rotates the spool, the degree of rotation of the spool varying substantially as the square of the length of tape unwound, a time controlled switch connected in circuit with said source and having a rotatable control member for setting the switch, means mechanically interconnecting said spool and said control member for rotating said member in direct proportion to rotation of said spool in response to unwinding of said tape, said means including a ratchet secured to said member, an element rotatable with said spool, a pawl carried by said element and adapted to engage said ratchet for rotating the same, and spring means for returning said spool and pawl to its initial position when said tape is released.

11. A device for controlling a source of radiant energy comprising a time controlled switch having an actuating shaft adapted by rotation thereof to close the switch and to set the switch to open its circuit at a time proportional to the degree of rotation initially given to said shaft and at the same time to rotate said shaft in the reverse direction to its initial position, a spool journalled on said shaft, a ratchet fixed to said shaft, a rotatable element carrying a pawl thereon, means for rotating said element proportionally to rotations of said spool and means for rotating said spool in proportion to the square of the distance between said source and a surface to be irradiated.

12. A device for controlling a source of radiant energy comprising a time controlled switch having an actuating shaft adapted by rotation thereof to close the switch and to set the switch to open its circuit at a time proportional to the degree of rotation initially given to said shaft and at the same time to rotate said shaft in the reverse direction to its initial position, a spool journalled on said shaft and having a logarithmic spiral groove in its outer surface, a tape or cord wound on said spool in said groove, one end of said tape or cord being fixed to said spool and the other end being free to be extended and unwound from the spool thereby rotating the spool, a ratchet fixed to said shaft, an element rotatable in proportion to rotations of said spool, a pawl carried by said element and adapted to engage said ratchet for rotating said shaft, and spring means secured to said shaft and said spool for returning said spool to its initial position and thereby rewinding said tape or cord when it is released.

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