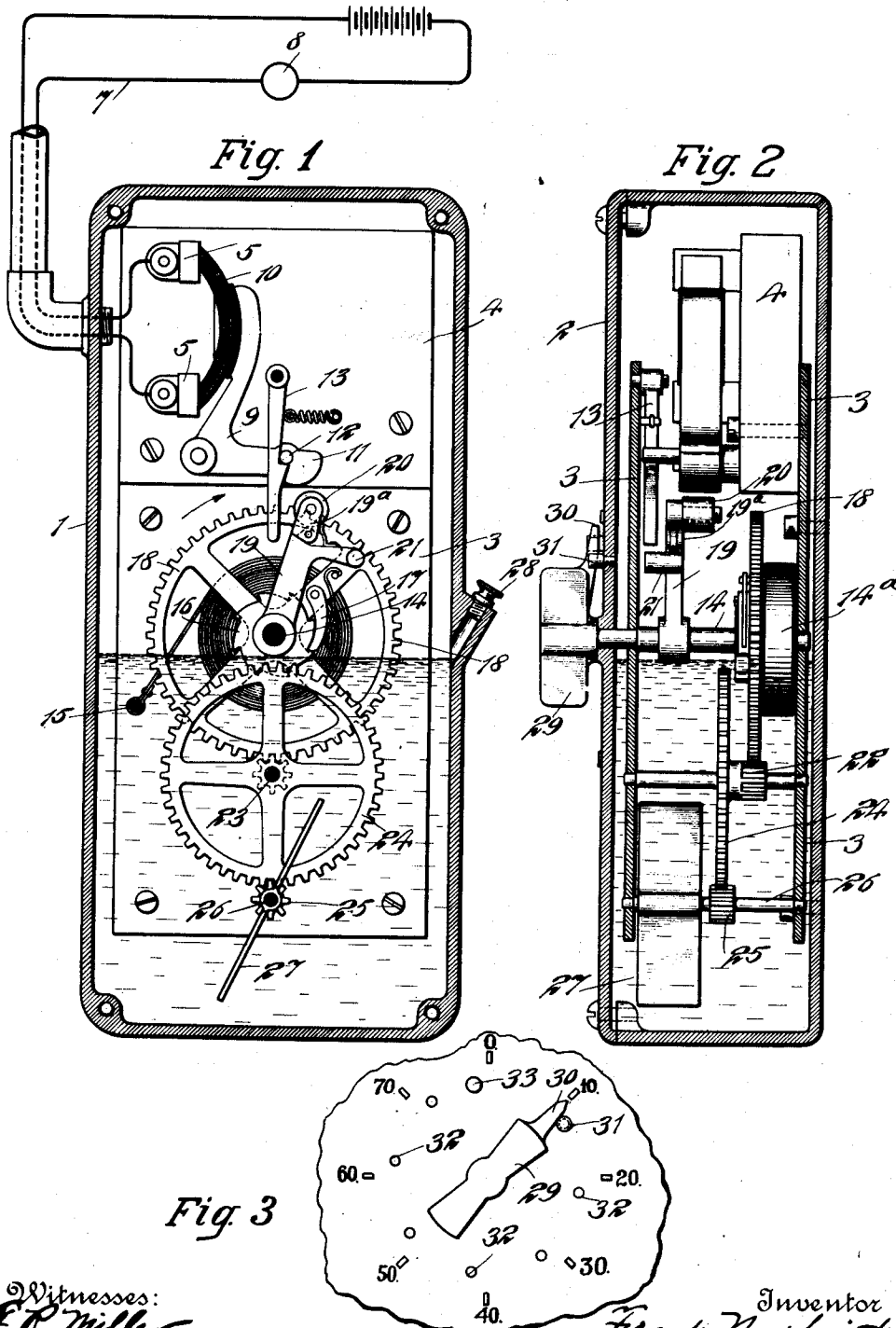


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TIME SWITCH FOR ELECTRIC CIRCUITS.
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TIME-SWITCH FOR ELECTRIC CIRCUITS.

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Specification of Letters Patent.

Patented Apr. 9, 1912.

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To all whom it may concern:

Be it known that I, FRANK W. SMITH, a citizen of the United States, and resident of Westfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Time-Switches for Electric Circuits, of which the following is a specification.

In public libraries it is desirable that each electric light, or each group of lights, shall be controlled by a time circuit breaker or switch in order that should the person using the light fail to open the light circuit said circuit will be automatically opened at the end of a predetermined time. It is the common experience in large public libraries that the lights are left burning, with the resultant burning out of the lamps and waste of electric energy.

A time switch or circuit breaker for use in public libraries must operate comparatively slowly for the reason that it is not desired to open the circuit and extinguish the lights at short intervals. Such a time switch must also be so constructed that it will be automatically set in operation by the switch button or key used for closing the light circuit in order that there will be no possibility of closing the light circuit without at the same time setting the switch in operation. These switches must also be simple and compact in construction in order that they may be placed in convenient position for operation. It is also necessary in switches for use in libraries that they be so constructed as to operate absolutely without noise. It is manifest that a great many of these switches must be used and that if there be the slightest noise from each of them the noise in the aggregate would be very annoying.

It is the main object of this invention to provide a time switch which will in every way satisfy the requirements of a switch for use in public libraries.

It is a further object of this invention to provide a spring motor or clock-work mechanism for operating the time switch, and to provide said motor with a retarding device arranged to secure a very slow operation of the motor.

Another object of the invention is to provide the clock-work or spring motor with a rotatable retarding device and to immerse said retarding device in a yieldable, readily

displaceable material inclosed in a suitable casing so that said retarding device will rotate in said material, the size of the rotatable retarding device and the density of the displaceable material being so proportioned as to secure the desired speed of the motor.

Another object of the invention is to immerse the rotatable retarding device in a readily displaceable material of such a nature that its density will not be varied to any appreciable degree by evaporation or ordinary changes in temperature. The importance of this condition of the retarding material will be manifest. If the density of the retarding material should be varied to a material extent by evaporation or by change in temperature the motor would operate at variable speeds and might be rendered inoperative if the retarding material should be materially increased in density by either evaporation or a decrease in temperature.

There are other equally important objects and advantages of the invention which will be fully hereinafter set forth.

In the drawings: Figure 1 is a vertical sectional view of the casing inclosing the switch operating mechanism, said mechanism being shown in front elevation, and a lamp circuit being diagrammatically shown as connected to the switch points; Fig. 2 a vertical sectional view of the switch complete, the operating parts being shown in side elevation; and Fig. 3 a front elevation of the circuit closing and switch setting button or key.

Referring to the various parts by numerals, 1 designates the switch casing which is in the form of a box closed by a front cover plate 2, said plate being secured in position in such manner as to secure an air and moisture-proof joint between said parts. Mounted in this box are two motor supporting side plates 3 and to the upper end of one of these plates is rigidly secured the switch-carrying plate 4 of slate or other suitable insulating material. To this plate are secured two contacts 5 separated a suitable distance from each other and to which are connected the terminals of a light circuit 7; the circle 8 diagrammatically representing a lamp in said circuit. Pivoted on this switch plate is a switch lever 9 carrying the switch contact plate 10 adapted to engage the contacts to complete the light

circuit. This contact plate is insulated from the switch lever in any suitable manner. The lower substantially horizontal arm 11 of the switch lever is provided with a laterally projecting latch pin 12 which is adapted to be engaged and held by a spring latch 13 when the switch lever is raised to complete the lighting circuit. The lower end of the latch projects considerably below the latch pin on the switch lever and is adapted to be engaged and moved to release the switch lever, as will be hereinafter described.

Mounted in the motor supporting plates is a horizontal main operating or driving shaft 14. This shaft carries near one of its ends and within the casing or box 1, a spiral spring, 14^a in the nature of a clock spring, the inner end of said spring being connected to the shaft and the outer end thereof being connected to a stud or bar 15 connected rigidly to the side plates 3. Rigidly secured to said driving shaft is a ratchet wheel 16 which is adapted to be engaged by a pawl 17 carried by a large driving gear 18 loosely mounted on said shaft. Rigidly mounted on said shaft is a switch setting arm 19 which extends upwardly and is provided with a small antifriction operating roller 20 which is adapted to engage the free end of the switch lever, and raise it to its closed position when the operating shaft is moved in the proper direction. Carried by this switch setting arm is a latch releasing finger 21 which is in position to engage the lower end of the latch 13 when the switch setting arm returns to its normal inoperative or unset position. The large driving gear 18 meshes with a small pinion 22 on a counter shaft 23; this latter shaft carrying a large pinion 24 which in turn meshes with another small pinion 25 secured to a retarder shaft 26. On the retarder shaft is arranged a rotating retarder 27, as a mixer or other device. This rotating device may be of any suitable shape and of any desired size, its shape and size being governed by conditions which will be hereinafter set forth. The retarder shaft and the counter shaft are preferably arranged below the main driving shaft, but, of course, they may be arranged in any suitable position.

To insure the switch operating arm 19 passing freely under the arm 11 of the switch lever when said arm is returning to its normal inoperative position, said switch operating arm may be formed in two parts hinged together as shown in Fig. 1, a light spring holding the roller carrying part 19^a in its proper operative position to permit said part to yield sufficiently to permit the roller 20 to pass under the arm 11 when returning to its normal or inoperative position on the left hand side of the latch 13. The part 19^a is formed with a shoulder at

its inner end which rests against a corresponding shoulder on the main part of the arm to prevent the said pivot portion turning on its pivot when the switch operating arm is thrown to the right to set the switch. The lower portion of the box 1 is liquid-tight so that it is adapted to contain a suitable liquid or semi-liquid material, a charging opening being provided at a suitable point, said opening being closed by a suitable screw plug 28.

Within the lower portion of the switch inclosing casing I preferably place a liquid or semi-liquid which will not appreciably evaporate or vary its density at ordinary temperatures. Sufficient of this material is placed in the casing or box 1 to completely immerse the retarding device so that said material must be displaced as said device is rotated. It is manifest that by properly proportioning the retarding device to the density of the retarding material in the box the motor may be permitted to operate at the desired slow speed, notwithstanding the fact that speed multiplying power reducing gears are introduced between the power or main spring shaft and the retarder shaft. It is also manifest that by immersing or submerging the retarding device in a displaceable material said device will be so retarded and its operation will be so slow that it will be absolutely noiseless.

I prefer to employ as a retarding material, an oil which will remain of a constant density throughout considerable variations in temperature and which will very slowly evaporate. By providing sufficient oil within the box to immerse all of the intermeshing gears as well as the retarding device the device will be absolutely noiseless; will be thoroughly lubricated and will be kept in a constant operative condition.

It is manifest that any suitable soft displaceable retarding material may be used in the box or casing of the switch device; and it is also manifest that if desired the retarding device or retarder alone may be inclosed in a box and immersed in a suitable displaceable retarding material. It is manifest that it is not absolutely necessary that the operating gears be immersed in the oil, although by arranging the apparatus as shown the oil serves the double purpose of lubricating the operative parts and securing a slow rotation of the retarder.

It is clear that with the short train of speed multiplying gearing shown in the drawing the speed of the operating shaft would not be retarded to any material extent by the retarder if it were free of the retarding material. On the projecting end of the operating shaft is rigidly secured a switch operating button or key 29 by means of which said shaft may be rotated to swing the switch setting arm to the right, as indi-

5 cated by the arrow in Fig. 1, sufficiently to
 cause the roller 20 to engage the under sur-
 face of said switch lever and raise it to its
 set position, the latch 13 snapping under the
 10 latch pin 12 and retaining the switch in its
 set position. On the switch button is a
 pointer and stop-arm 30 which is adapted to
 engage a stop pin 31 in the face of the box
 closure, said stop pin limiting the movement
 15 of the switch button and consequently of the
 lever-setting arm 19. This operation of the
 switch button partially rotates the operating
 shaft and tightens the spring thereon. When
 the button is released the spring rotates the
 20 shaft, which motion is transmitted through
 the gearing to the retarder as previously de-
 scribed. The latch releasing finger 21 en-
 gages the lower end of the latch and moves
 it away from the latch pin on the switch lever
 and permits said lever to drop down-
 wardly thereby breaking the light circuit
 at the contacts.

25 In the face of the cover plate is formed a
 series of apertures 32 into any one of which
 the stop pin 31 may be inserted to vary the
 time required for the operation of the switch.
 Each of these apertures is numbered, as
 shown in Fig. 3 so that if it be desired to set
 30 the switch to open the light circuit at the end
 of twenty minutes, stop pin 31 is placed in
 the aperture opposite the number 20, and so
 on throughout the series. A permanent stop
 33 is arranged to be engaged by the stop arm
 30 after the latch has been released from the
 35 latch pin and the lamp circuit has been
 opened.

40 The ratchet wheel 16 is shown as provided
 with eight teeth. In the closure plate there
 are formed eight apertures 32 spaced equal
 distances apart and corresponding to the
 eight teeth on the ratchet wheel. The object
 of this is to permit the driving shaft to be
 45 rotated by means of the switch operating
 button a distance equal to one of the ratchet
 teeth or a multiple of that distance. If the
 switch is to be timed to open the light cir-
 cuit at the end of ten minutes the limiting
 stop is placed in the aperture adjacent the
 50 numeral 10 on the face plate. This will per-
 mit the driving shaft to be rotated suffi-
 ciently to move the ratchet wheel around one
 tooth each time the switch is operated so
 that the spring will always be restored to its
 55 original tension by the operation of the
 switch button, the movement of the shaft
 through the switch button compensating for
 the unwinding movement of the shaft under
 the action of the spring. If the switch is to
 60 be operated to open the light circuit at the
 end of twenty minutes the movable stop is
 placed in the aperture 32 adjacent the num-
 eral 20. This will permit the driving
 shaft to be rotated sufficiently to pass two of
 65 the ratchet teeth under the locking pawl.
 This will give a longer travel to the switch

operating arm, and, as before, the movement
 of the switch button will compensate for the
 unwinding of the spring. It will thus be
 seen that in every operation the driving
 shaft will be rotated sufficiently in setting
 70 the switch to compensate for the unwinding
 of the spring in operating the motor. It is,
 therefore, clear that the motor spring will
 always be in operative condition and cannot
 unwind, or run down. When the spring is
 75 once set in operative position it will remain
 in that condition throughout the life of the
 switch apparatus.

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

1. A time switch comprising a box or cas-
 ing, a circuit closing switch therein, a latch
 to hold said switch to maintain the circuit
 closed, a spring motor in said box, one end
 85 of the driving shaft of said motor extending
 through said box, a switch setting arm car-
 ried by the driving shaft within the box and
 adapted to move the switch to its locked po-
 sition, when said shaft is rotated to wind the
 spring thereon, a releasing finger carried by
 said arm and adapted to release the latch
 when the driving shaft is rotated by the
 spring tension, a power reducing gear train
 connected to and operated by the driving
 95 shaft, a rotatable retarding device operated
 by said gear train, a filling of readily dis-
 placeable lubricating material in the box and
 submerging the retarding device and permit-
 ting said device to rotate very slowly, a
 100 switch operating button connected to the
 outer end of the driving shaft, a stop for
 said button to prevent the operation of the
 motor, and a stop to limit the rotation of the
 button in its switch operating movement.

2. A time switch comprising a circuit clos-
 ing device, a latch to hold said device to
 maintain the circuit closed, a spring motor
 including a driving shaft, and a power re-
 110 ducing gear train, a switch setting arm car-
 ried by the driving shaft and adapted to move
 the switch device to its locked position when
 said shaft is rotated to wind the spring
 thereon, a releasing finger operated by the
 motor to release the latch when the driving
 115 shaft is rotated by the spring tension, a ro-
 tatable retarding device operated by the gear
 train, a box inclosing said retarding device,
 a filling of displaceable material in the box
 submerging the retarding device and permit-
 120 ting said device to rotate very slowly, a
 switch operating button connected to one end
 of the driving shaft, a stop adapted to be en-
 gaged by said button to hold the motor
 against operation, and an adjustable stop to
 125 limit the rotation of the button in its switch
 operating movement, whereby in setting the
 switch the driving shaft will be rotated and
 the operating spring wound thereon an
 amount equal to the unwinding of said 130

spring in returning the switch operating button to the permanent stop.

3. A time switch comprising a circuit closing switch, a latch to hold said switch to maintain the circuit closed, a spring motor including a driving shaft, a driving spring connected at one end to said shaft and at its other end to a permanent fixed part, a ratchet wheel rigidly fixed to said shaft, a driving gear loosely connected to said shaft and carrying a pawl engaging the ratchet wheel of said shaft whereby the gear will be driven through said ratchet wheel, a pawl, a gear train operated through said driving gear, a retarding device operated by said gear train, a switch setting arm carried by the driving shaft and adapted to move the switch to its locked position when said shaft is rotated to wind the spring thereon, a releasing device operated by the motor and adapted to release the latch when the driving shaft is rotated by the spring tension, a switch operating button connected to one end of the driving shaft, a permanent stop adapted to be engaged by said button to hold the motor inoperative but permitting the driving shaft to be rotated by said button to set and lock the switch, an adjustable stop to limit the rotation of the button and the driving shaft in its switch operating movement, said stop being so adjustable as to permit of the rotation of the driving shaft a distance equal to one ratchet tooth or a multiple of said distance, whereby the rotation of the driving shaft in setting the switch will wind the spring thereon sufficiently to compensate for the unwinding of the spring in returning the motor to its normal inoperative position.

4. A time switch comprising a box or casing, a circuit closing switch therein, a latch to hold said switch to maintain the circuit closed a spring motor in said box and including a driving shaft, and a driving spring wound thereon, a ratchet wheel rigidly secured on said driving shaft, a driving gear loosely mounted on said driving shaft, a gear train operated by said driving gear, a retarding device operated by said gear train, a filling of lubricating material in the box and submerging the retarding device, a switch setting arm carried by the driving shaft, a releasing finger operated by the said shaft, a switch operating button connected to one end of the driving shaft, a stop for said button to hold the motor inoperative, a series of apertures in the box corresponding in number to the teeth of the ratchet wheel on the driving shaft and arranged equal distances apart around said driving shaft, and an adjustable stop adapted to be inserted in any one of said apertures, substantially as described for the purpose set forth.

5. A time switch comprising a circuit clos-

ing switch, a latch to hold said switch closed, a spring motor, a ratchet wheel fixed to the driving shaft of said motor, a driving gear loosely connected to said shaft, a pawl carried by said gear and engaging the ratchet wheel, a gear train operated through said driving gear, a retarding device operated by said gear train, means operated by the driving shaft to move the switch to its locked position when said shaft is rotated to wind the spring thereon, a switch operating button connected to one end of the driving shaft and an adjustable stop to limit the rotation of the button and the driving shaft in its switch operating movement.

6. A time switch comprising a circuit closing switch, a latch to hold said switch closed, a spring motor, a ratchet wheel fixed to the driving shaft of said motor, a driving gear loosely connected to said shaft, a pawl carried by said gear and engaging the ratchet wheel, a gear train operated through said driving gear, a retarding device operated by said gear train, means operated by the driving shaft to move the switch to its locked position when said shaft is rotated to wind the spring thereon, a switch operating button connected to one end of the driving shaft, a plate through which the motor driving shaft extends, a stop on said plate for said button to hold the motor inoperative, a series of apertures in the said plate corresponding in number to the teeth of the ratchet wheel on the driving shaft and arranged equal distances apart around said driving shaft, and an adjustable stop adapted to be inserted in any one of said apertures, substantially as described.

7. A time switch comprising a box or casing, a circuit closing switch therein, a latch to hold said switch to maintain the circuit closed, a spring motor in said box and including a driving shaft, and a driving spring wound thereon, a ratchet wheel rigidly secured on said driving shaft, a driving gear loosely mounted on said driving shaft, a gear train operated by said driving gear, a retarding device operated by said gear train, a switch setting arm carried by the driving shaft, a releasing finger operated by the said shaft, a switch operating button connected to one end of the driving shaft, a stop for said button to hold the motor inoperative, a series of apertures in the box corresponding in number to the teeth of the ratchet wheel on the driving shaft and arranged equal distances apart around said driving shaft, and an adjustable stop adapted to be inserted in any one of said apertures, substantially as described for the purpose set forth.

8. A time switch comprising a circuit closing device, a latch to hold said device to maintain the circuit closed, a drive shaft, a driving spring connected to said shaft, a

switch setting arm carried by said shaft and adapted to move the switch device to its locked position when the driving shaft is rotated against the spring tension, a releasing finger rotatable with said shaft and adapted to release the latch when the driving shaft is rotated by the said spring, a power reducing gear train connected to and operated by the driving shaft, a retarding device operated by said gear train, a switch operating button connected to one end of the driving shaft, a stop adapted to be engaged by said button to hold the motor against operation, and an adjustable stop to limit the rotation of the switch operating button in its switch operating movement, whereby in setting the switch the driving shaft will be rotated and the operating spring wound thereon an amount equal to the unwinding of said spring in returning the switch operating button to its permanent stop.

9. A time switch comprising a liquid receptacle, a circuit closing switch, a latch to

hold said switch to maintain the circuit closed, a spring motor, a retarding device in said liquid receptacle and operatively connected to the motor, a readily displaceable lubricating retarding and sound-deadening liquid in the liquid receptacle and submerging the retarding device, and operating means therefor, means to simultaneously tighten the spring of the motor and move the switch to its closed position, means to limit the movement of the spring tightening means, means operating when the spring is released to release the latch and thereby open the switch a predetermined time after the spring is released, and means to stop the spring after the latch is released.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

FRANK W. SMITH.

Witnesses:

JOHN AITKEN,
WM. R. DAVIS.