April 23, 1957 J. R. HOLLINS 2,789,426

THERMO-ELECTRICALLY CONTROLLED LATCH

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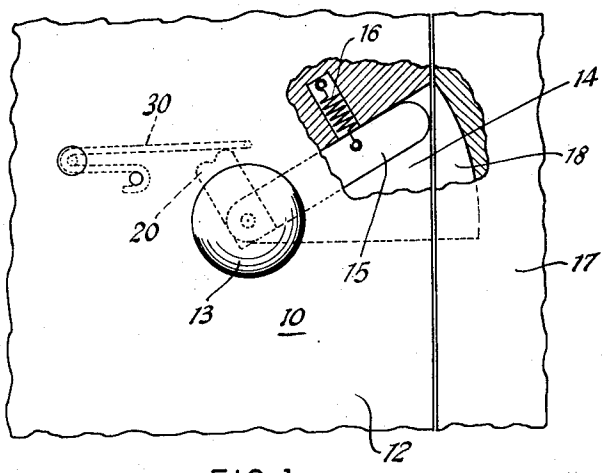


FIG. 1

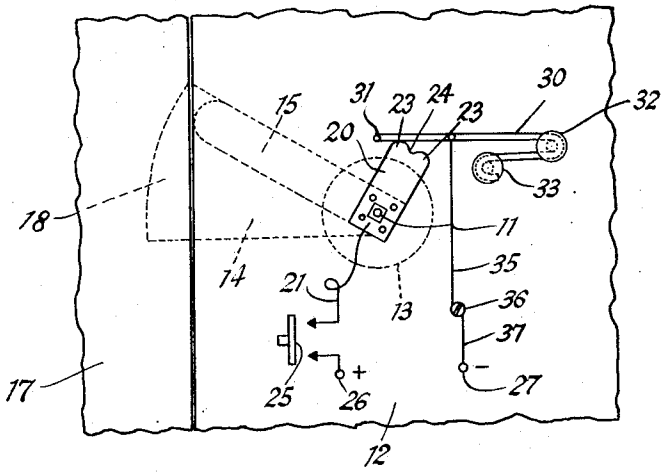


FIG. 2

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FIG. 3

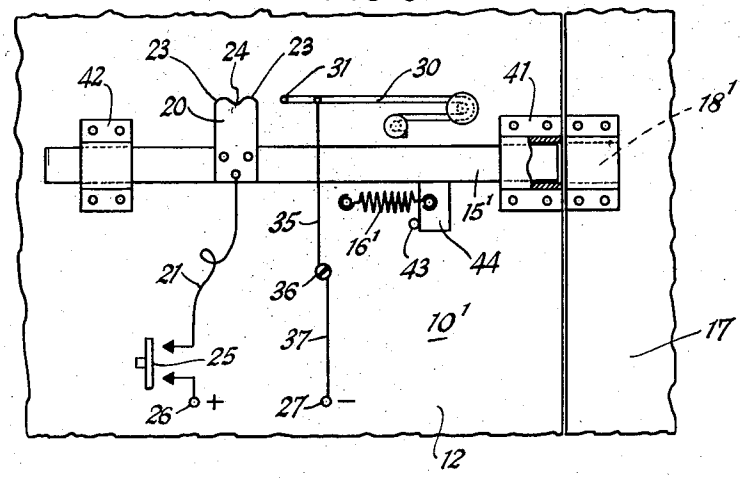
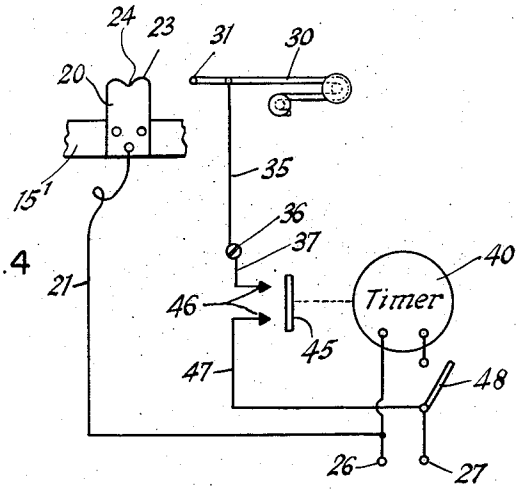


FIG. 4



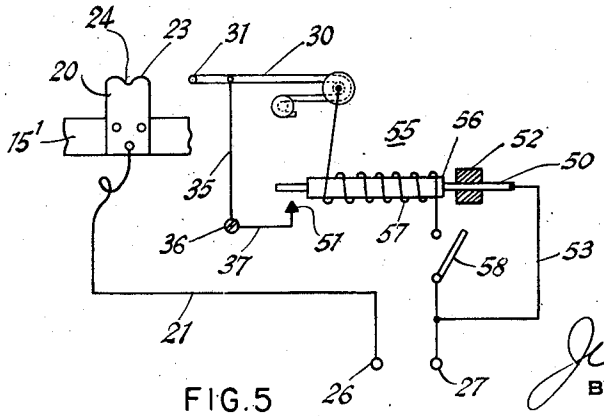


FIG. 5

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United States Patent Office 2,789,426 Patented Apr. 23, 1957

2,789,426

THERMO-ELECTRICALLY CONTROLLED LATCH

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Application July 19, 1954, Serial No. 444,215

12 Claims. (Cl. 70—267)

This invention relates to electric remote and/or automatically controlled locks or latches and, more particularly, to a simplified lock of this type which is released by electrically energizing a thermo-responsive lock bolt retaining element.

Electrically operated and controlled locks are known which comprise magnetic means for operating, latching and releasing a lock bolt. These locks, while practical in operation, are complicated in construction and require substantial power to operate.

The present invention is directed to an electrically operated or controlled lock in which, when a lock bolt, normally biased to one position, is moved to another position, such as a locked position, an electrically conductive latching element fixed to the lock bolt is automatically releasably engaged by electrically conductive latch means and retained in the operative position. The latch means is continuously biased to the latch release position but is restrained in the latching position by a thermo-responsive retainer, such as a high resistance wire secured between the latch means and a fixed point.

The conductive latching element is electrically connected to one terminal of a source of electric potential. The other terminal of the source is connected to the fixed end of the high resistance wire through a normally open switch. With the lock bolt in operated position, the energizing circuit for the high resistance wire is complete except for the normally open switch.

When the switch is closed, current flows through the latch means retainer wire, heating and expanding the wire. The latch means is thus permitted to move, under its bias, to a latch element releasing position. The released lock bolt is then biased to its first or unoperated position. The normally open switch may be manually closed or may be closed by a timer or by a special key.

In a modified form of the latch, a time delay may be introduced by connecting a thermostatically operated switch between the high resistance wire fixed point and the other source terminal. A heating circuit for this switch is connected in series with the latch means and the afore-mentioned normally open switch. When the latter is closed, the heating circuit is energized to heat the thermostatically operated switch. After a preset interval, this latter switch closes the circuit through the resistance wire to release the latch.

For an understanding of the invention, reference is made to the following detailed description of typical embodiments thereof as illustrated in the accompanying drawings. In the drawings:

Fig. 1 is a partial front elevation view of a door and door jamb illustrating one form of the latch;

Fig. 2 is a rear elevation view corresponding to Fig. 1 and schematically illustrating the electrical connections;

Fig. 3 is a part elevation and part sectional view of another form of latch embodying the invention;

Fig. 4 is a schematic wiring diagram illustrating a timer operated switch controlling the latch; and

Fig. 5 is a scehmatic wiring diagram illustrating a time delay control of the latch.

Referring to Figs. 1 and 2, the invention is illustrated as incorporated in an electrically released latch arrangement generally indicated at **10** in which a bolt **15** is swingably mounted on a shaft **11** mounted through a door **12**. An operating knob **13** is secured to the shaft **11**. Bolt **15** is swingable in a generally triangular slot **14** in the free edge of a door **12**, and is biased to the retracted position by a tension spring **16**. When knob **13** is turned clockwise, bolt **15** enters a suitable keeper on door jamb **17**, the keeper being illustrated as an arcuate slot **18** in the edge of jamb **17**. In this position, bolt **15** is automatically latched by electrically releasable means to be described.

The inner or back end of shaft **11** has secured thereto a conductive latch element or plate **20**. A conductor **21** is schematically illustrated as connecting latch element **20** to a normally open push button **25** connected to one terminal **26** of a suitable source of electric potential. The outer edge of plate **20** has convex cam surfaces **23**, **23** intersecting in a notch **24**. When knob **13** is turned to move bolt **15** to a locking position, a cam surface **23** of element **20** engages and forces outwardly the bent end **31** of a conductive metal latch means, such as a spring **30**, so that end **31** snaps into recess **24** to retain bolt **15** engaged in keeper slot **18**.

Spring **30** comprises a bent spring wire anchored to door **12** by pins or screws **32**, **33** in such a manner that its free bent end **31** is normally biased outwardly away from latch element or plate **20**.

A high resistance wire **35** of "Nichrome" or the like is connected between spring **30** and a screw or pin **36** on door **12**. When cold and contracted, wire **35** pulls spring end **31** inwardly to engage in notch **24** of plate **20**. A conductor **37** connects the fixed end of wire **35** to the other terminal **27** of the source of electric potential.

When knob **13** moves bolt **15** to the latching position, engagement of spring end **31** in notch **24** latches bolt **15** in the locking position. At the same time, an electric circuit including wire **35** is completed subject to closure of push button **25**.

To release bolt **15**, button **25** is depressed so that the circuit is completed. Current flow through wire **35** heats and expands this wire so that spring end **31** is allowed to move out of notch **24**. Spring **16** thereupon snaps bolt **15** to the release position, at the same time breaking the electric circuit.

Fig. 3 illustrates the invention as incorporated in a reciprocating bolt or latch arrangement **10'**. Identical elements have been given the same reference characters and corresponding elements have been given the same reference characters primed.

Bolt **15'** is reciprocably mounted in guides **41**, **42** on door **12**, being biased to a retracted position by spring **16'**. A stop **43** on door **12** engages an abutment **44** on bolt **15'** to limit retraction of the latch.

When bolt **15'** is projected to enter keeper **18'** on door jamb **17**, end **31** of spring **30** rides over a cam surface **23** to engage in notch **24**, thus locking bolt **15'** in the projected or locking position. When push button **25** is closed, bolt **15'** is released in the same manner as described for bolt **15** of Figs. 1 and 2.

Fig. 4 schematically illustrates how the latch arrangement may be used as a time lock. In this arrangement, conductor **21** connects latch element **20** directly to terminal **26**. Conductor **37** connects wire **35** to one of a pair of contacts **46** controlled by a contact element **45** op-

erated by a timer 40. The other contact 46 is connected to terminal 27 by a conductor 47. Timer 40 is energized from terminals 26, 27 through a control switch 48.

When bolt 15' is moved to the locking position, it is retained there by engagement of wire end 31 in notch 24 until such time as timer contact element 45 bridges contacts 46 to complete the heating circuit for wire 35.

In some instances, it may be desirable to delay release of the latch for a pre-set interval following operation of a releasing switch. Fig. 5 shows an arrangement providing such time delay. In this arrangement, conductor 21 connects element 20 directly to terminal 26. Conductor 37 connects wire 35 to a contact 51.

Contact 51 is arranged to be engaged by a thermally responsive conductive metal strip 50 forming part of a thermostatic time delay device generally indicated at 55. One end of strip 50 is anchored in a dielectric mounting 52, and this end is connected to terminal 27 by a conductor 53. When heated, strip 50 bends so that its free end engages contact 51 to connect this contact and wire 35 to terminal 27.

An insulating sleeve 56 is placed on strip 50 and wound with a heating wire 57 electrically connected at one end to spring 30 and thus to wire 35. The other end of wire 57 is connected to terminal 27 through a normally open switch or push button 58.

To release bolt 15', after the latter has been moved to the locking position engaging element 20 with end 31 of spring 30, switch 58 is closed. This completes the following circuit: terminal 26, conductor 21, element 20, spring 30, heating wire 57, switch 58 and terminal 27. Current flowing through wire 57 heats strip 50 so that the latter bends to engage contact 51. Spring 30 is thus connected to terminal 27 through wire 35, conductor 37, contact 51, strip 50 and conductor 53. Wire 35 thereupon heats and expands to release spring 30 from latch element 20, thus releasing bolt 15'.

While bolts 15 and 15' have been shown as normally biased to the retracted position and electrically released to the retracted position, it will be apparent that the arrangement is equally applicable to latches normally biased and released to the latching position and manually retractable.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the invention principles, it will be apparent that the invention may be otherwise embodied without departing from such principles.

What is claimed is:

1. An electrically operated lock bolt mechanism comprising, in combination, a bolt movable between an operated position and a restored position; means biasing said bolt to the restored position; latch means operable to a bolt latching position to releasably retain said bolt in the operated position, said latch means being biased to the bolt releasing position; a thermally expansible electric resistance element connected at one end to said latch means and at the other end to a fixed part of the mechanism and effective, when contracted, to constrain said latch means to the bolt latching position and, when expanded, to release said latch means to the bolt releasing position; and means, including a circuit maker and breaker, for applying an electric potential to said expansible element.

2. An electrically operated lock bolt mechanism comprising, in combination, a bolt movable between an operated position and a restored position; means biasing said bolt to the restored position; latch means operable to a bolt latching position to releasably retain said bolt in the operated position, said latch means being biased to the bolt releasing position; a thermally expansible electric resistance element connected at one end to said latch means and at the other end to a fixed part of the mechanism and effective, when contracted, to constrain said latch means to the bolt latching position and, when expanded, to release said latch means to the bolt releasing position; a normally open circuit maker and breaker; and circuit connections, including means movable with said bolt when moved to the operated position, connecting said circuit maker and breaker to said element to apply an electric potential thereto upon closure of said circuit maker and breaker.

3. A bolt mechanism as claimed in claim 2 in which said element comprises a high resistance wire.

4. A bolt mechanism as claimed in claim 2 in which said circuit maker and breaker comprises a normally open manually operable switch.

5. A bolt mechanism as claimed in claim 2 in which said circuit maker and breaker comprises a normally open timer-operated switch.

6. An electrically operated lock bolt mechanism comprising, in combination, a bolt movable between an operated position and a restored position; means biasing said bolt to the restored position; latch means operable to a bolt latching position to releasably retain said bolt in the operated position, said latch means being biased to the bolt releasing position; a thermally expansible electric resistance element connected at one end to said latch means and at the other end to a fixed part of the mechanism and effective, when contracted, to constrain said latch means to the bolt latching position and, when expanded, to release said latch means to the bolt releasing position; a normally open heating circuit including said element; said normally open heating circuit including a thermostatic device operable, when heated for a pre-set time, to close said heating circuit; electric heating means for said device; and means, including a circuit maker and breaker, for applying an electric potential to said heating means.

7. An electrically operated lock bolt mechanism comprising, in combination, a bolt movable between an operated position and a restored position; means biasing said bolt to the restored position; latch means operable to a bolt latching position to releasably retain said bolt in the operated position, said latch means being biased to the bolt releasing position; a thermally expansible electric resistance element connected at one end to said latch means and at the other end to a fixed part of the mechanism and effective, when contracted, to constrain said latch means to the bolt latching position and, when expanded, to release said latch means to the bolt releasing position; a normally open heating circuit including said element and means movable with said bolt when moved to the operated position; said normally open heating circuit including a thermostatic device operable, when heated for a preset time, to close said heating circuit; electric heating means for said device; and means, including a circuit maker and breaker and said means movable with said bolt when moved to the operated position, for applying an electric potential to said heating means upon closure of said circuit maker and breaker.

8. An electrically operated lock bolt mechanism comprising, in combination, a bolt movable between an operated position and a restored position; means biasing said bolt to the restored position; a conductive metal latch element carried by said bolt; a conductive metal latch spring releasably engageable with said latch element in the operated position of said bolt; said latch spring being biased to release said latch element; a thermally expansible electric resistance element connected at one end to said latch spring and at the other end to a fixed part of the mechanism and effective, when contracted, to constrain said latch spring to the latch element engaging position and, when expanded, to release said latch spring to the latch element releasing position; and means including a circuit maker and breaker, said latch element and said latch spring for applying an electric potential to said expansible element.

9. A bolt mechanism as claimed in claim 8 in which said element comprises a high resistance wire.

10. A bolt mechanism as claimed in claim 8 in which said circuit maker and breaker comprises a normally open manually operable switch.

11. A bolt mechanism as claimed in claim 8 in which said circuit maker and breaker comprises a normally open timer-operated switch.

12. An electrically operated lock bolt mechanism comprising, in combination, a bolt movable between a operated position and a restored position; means biasing said bolt to the restored position; a conductive metal latch element carried by said bolt; a conductive metal latch spring releasably engageable with said latch element in the operated position of said bolt; said latch spring being biased to release said latch element; a thermally expansible electric resistance element connected at one end to said latch spring and at the other end to a fixed part of the mechanism and effective, when contracted, to constrain said latch spring to the latch element engaging position and, when expanded, to release said latch spring to the latch element releasing position; a normally open heating circuit, including said expansible element, said latch element, and said latch spring; a thermostatic device operable, when heated for a preset time, to close said heating circuit; electric heating means for said device; and means, including a circuit maker and breaker and said latch element when said bolt is moved to the operated position, for applying an electric potential to said heating means upon closure of said circuit maker and breaker.

No references cited.