

[54] **SAFETY DEVICE FOR A LOCK AND A LOCK INCLUDING SAID DEVICE**

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[51] Int. Cl. .... **E05b 63/00**

[58] Field of Search ..... 70/1.7, 127, 134, 268, 70/416, 419, 431

[56] **References Cited**

**UNITED STATES PATENTS**

2,318,908 5/1943 Welch ..... 70/419

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[57]

**ABSTRACT**

For a lock comprising a bolt, a keeper in which the bolt is engageable in the closing position of the lock and means for shifting the bolt. The safety device comprises delayed-action means for blocking the bolt and precluding displacement of the bolt in the direction for opening the lock a predetermined interval of time after the bolt has been displaced an initial partial distance in the direction for opening the lock by the shifting means.

**19 Claims, 6 Drawing Figures**

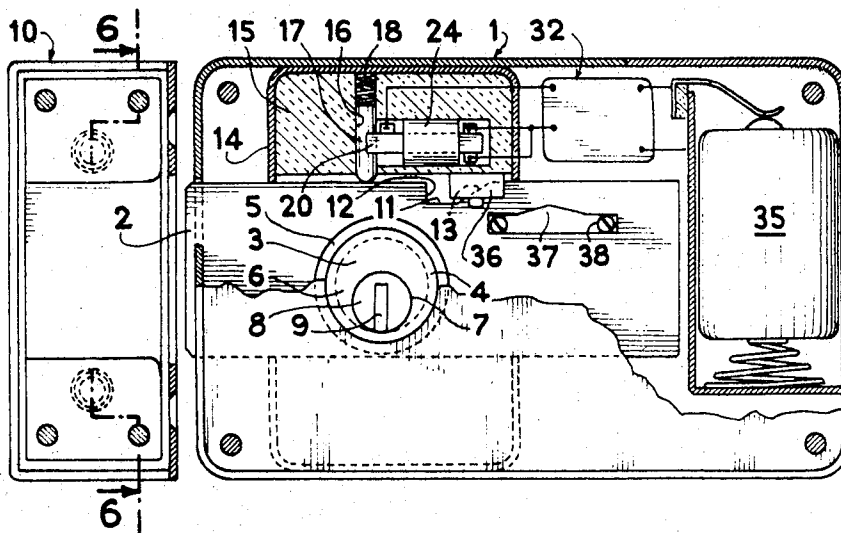


FIG. 1

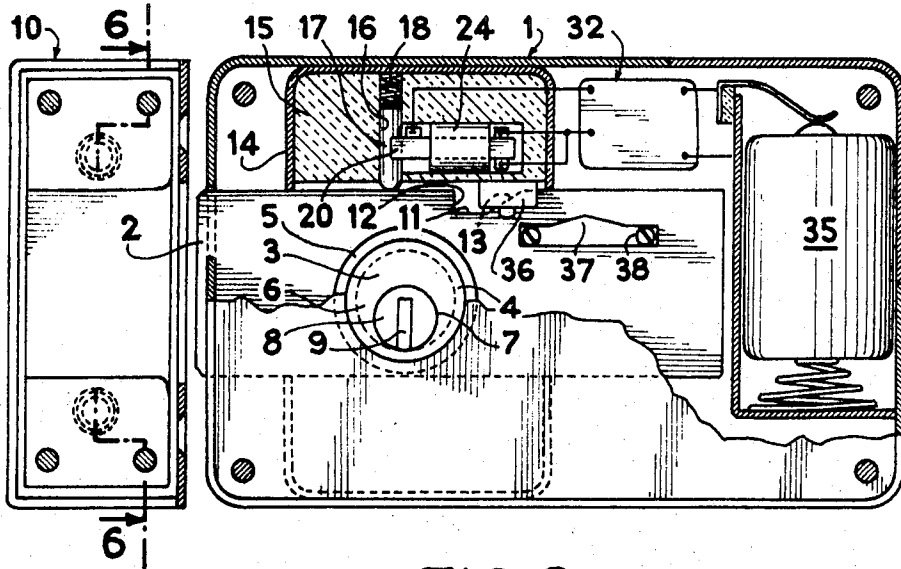


FIG. 2

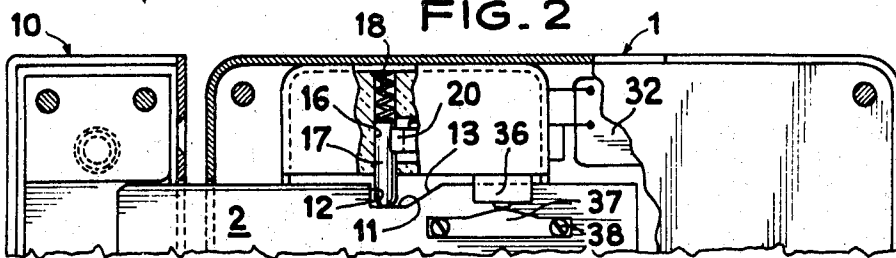


FIG. 6

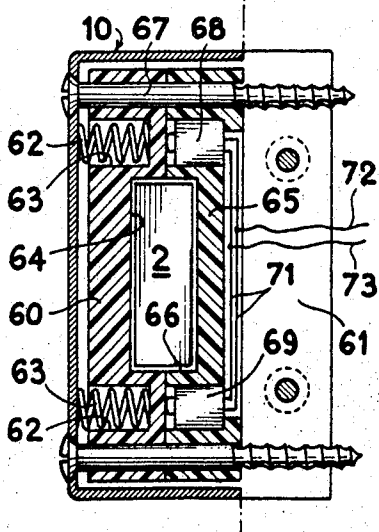


FIG. 3

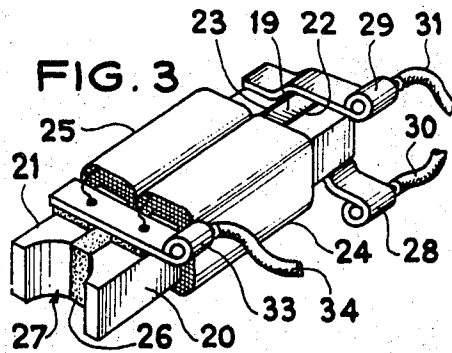


FIG. 4

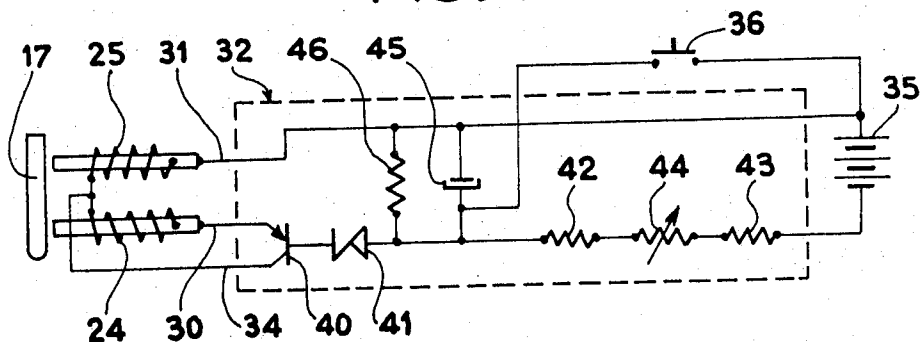
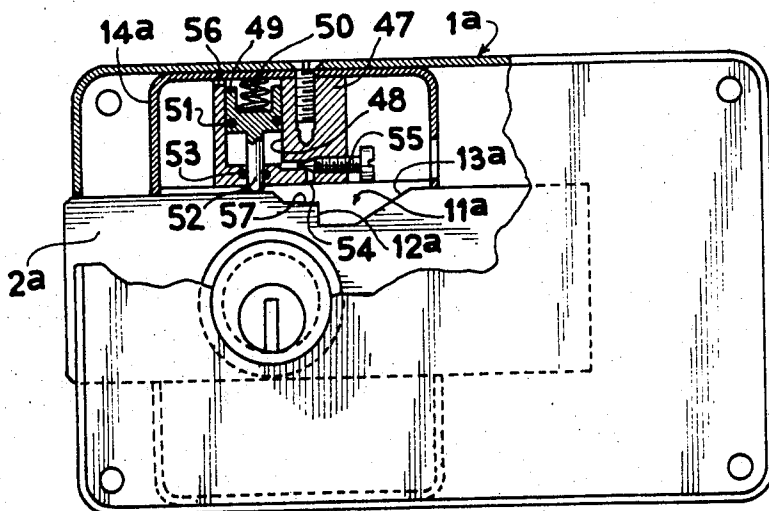


FIG. 5



# SAFETY DEVICE FOR A LOCK AND A LOCK INCLUDING SAID DEVICE

The present invention relates to locks and more particularly to safety devices for locks adapted to prevent the opening of the lock by means other than the key provided for normal operation of the lock.

It is known that conventional locks, even when very perfected, may be picked by a specialist who has sufficient time and special tools, without harming the lock.

Consequently, a conventional lock offers a rather illusory protection for the premises entry to which the lock is intended to prevent.

Further, a premises thus protected may be entered with no subsequent visible sign of breaking in.

An object of the present invention is to overcome the aforementioned drawbacks and provide a safety device for a lock which renders the opening or unlocking of the lock impossible by means other than the key intended for actuating the lock.

The invention provides a safety device for a lock comprising a bolt, a keeper in which the bolt is engaged in the closing position of the lock and bolt actuating means, wherein delayed-action blocking means prevent displacement of the bolt in the direction for opening the lock after a predetermined interval of time, said blocking means being brought into action by an initial partial displacement of the bolt by said actuating means.

Owing to this arrangement, an attempt to unlock the lock by picking it must fail since, whatever be his experience, a specialist in the matter requires much more time for opening the lock by picking it than if he had possession of the key.

Now, the delayed-action blocking means are adapted first to allow the time necessary for a person in possession of the key to normally actuate the lock and then to block the displacement of the bolt in the direction for opening if at the end of the interval of time necessary for normally opening the lock the bolt had undergone a part of the displacement but had not been completely disengaged from the keeper.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings.

In the drawings:

FIG. 1 is an elevational view, with parts cut away, of a lock provided with a safety device according to the invention, an alarm actuating device being furthermore mounted in the keeper;

FIG. 2 is a partial elevational view, with parts cut away, of the lock shown in FIG. 1 and illustrating the action of the bolt blocking means;

FIG. 3 is a perspective view of electromagnetic means of a time delay means which are part of the delayed-action blocking means of the safety device shown in FIG. 1;

FIG. 4 is a circuit diagram of the time delay circuit of the safety device shown in FIG. 1-3;

FIG. 5 is an elevational view, with parts cut away, of a lock provided with another embodiment of the safety device according to the invention, and

FIG. 6 is a sectional view, taken on line 6-6 of FIG. 1, showing the alarm actuating device incorporated in the keeper of the lock.

In FIG. 1, the invention has been illustrated as being applied to a barrel-type lock.

This lock comprises, housed in a case 1 which is preferably of hard steel, such as Z 200 C 12 steel, so as to render the interior of the lock inaccessible by drilling, a bolt 2 which is normally shiftable by a barrel-type mechanism with the aid of a key (not shown).

The barrel 3 is advantageously protected against any attempt to drill by a protecting sleeve 4 also of hard steel. The sleeve 4 has at one end a flange 5 fixed to the case 1, for example by welding. At its other end, the sleeve 4 has an end wall provided with an eccentric aperture 7 closed by a disc or block 8 of hard steel which is provided with a slot 9 for the passage of the key and is rotatably mounted in the aperture 7 by means of a boss.

The bolt 2 is adapted to co-operate with a keeper 10 provided with an alarm actuating device which will be described hereinafter.

The bolt 2 is provided, substantially midway along its length, with a recess 11 formed in its upper part and having a vertical lateral wall 12 and an inclined wall 13 constituting a ramp.

Disposed in a housing 14 of the case 1 above the bolt 2 is a delayed-action blocking or stop means for stopping displacement of the bolt. This device comprises a block 15 of plastics material having a transverse aperture 16 in which is disposed a finger member 17 which is of magnetic material and biased in the direction of the bolt 2 by a spring 18. Embedded in the block 15 is a magnetic circuit constituted by a flat magnet 19 (FIG. 3) against the poles of which are applied two elongated pole pieces 20 and 21 which are electrically insulated from the magnet by thin films 22 and 23 of insulating material, for example varnish.

According to a modification, the magnet may be constituted by a block of plastics material having a charge of particles of magnetic material. In this case, such a magnet is practically non-conductive of electricity and the films of insulating material between its poles and the pole pieces are superfluous.

The pole pieces 20 and 21 respectively carry demagnetizing windings 24 and 25 the coils of which have opposite directions of windings. The ends of the pole pieces opposed to the magnet 19 are separated from each other by a block 26 of insulating material and constitute with the latter a recess in the shape of a portion of a cylinder 27 whose diameter is the same as the diameter of the aperture 16, the surface of the recess being flush with the surface of the aperture 16.

The windings 24 and 25 are respectively connected by one of their terminals to the pole pieces 22 and 23 each of which carries a connector 28, 29.

The conductors 30 and 31 for connection to a time delay circuit 32 (FIG. 1) are fixed to the connectors 28, 29.

The opposite ends of the windings 24 and 25 are connected to a common connector 33 which is insulated from the pole pieces 20 and 21 and to which is secured another conductor 34 for connection to the time delay circuit.

Thus it can be seen that the finger member 17 and the recessed ends of the pole pieces 20, 21 constitute a switch, the closure of which - achieved simultaneously with the closure of the magnetic circuit formed by the magnet 19, the pole pieces 20 and 21 and the finger member 17 - causes the connection in parallel of

the windings 24 and 25 between the conductors 29 and 30, on one hand, and the conductor 33 on the other.

The windings 24 and 25 are supplied with current by the time delay circuit 31 from a source of dc voltage, as a dry battery 35, disposed in the right part of the case 1.

The time delay circuit 32 is actuated by a micro-switch 36 fixed to the lower part of the block 15 containing the electromagnetic device for maintaining the finger member 17 for blocking the bolt 2. The push-member of this switch co-operates with a plate 37 which constitutes a cam and is secured to the lateral wall of the bolt by screws 38 in such position that the switch 36 is actuated when the recess 11 of the bolt is located in alignment with the finger member 17.

FIG. 4 shows the circuit diagram of the time delay circuit 32 and the electromagnetic device for maintaining the finger member 17 in position.

This circuit, supplied with current by the battery 35 shown in FIG. 1, essentially comprises a transistor 40 the base of which is connected to the negative terminal of the battery through a Zener diode 41, two fixed resistors 42, 43 and a variable resistor 44 connected in series.

The junction between the Zener diode 41 and the resistor 42 is connected to the positive terminal of the battery 35 through a capacitor 45 and a resistor 46 connected in parallel.

The collector of the transistor 40 is connected to the common terminal of the windings 24 and 25 through the conductor 34 shown in FIG. 3 and its emitter is connected to the positive terminal of the battery 35 through a switch formed by the pole pieces 20 and 21 and the finger member 17, the connections being ensured by the conductors 30 and 31 shown in FIG. 3.

The negative terminal of the capacitor 45 is connected to the positive terminal of the battery 35 through the microswitch 36 which is actuated by the cam 37 integral with the bolt 2.

The bolt shown in FIG. 5 is equipped with a safety device of different design to that of the safety device shown in the lock illustrated in FIG. 1.

This safety device comprises a small air cylinder device 47 disposed in the housing 14a provided in the upper part of the case 1a of the lock.

Mounted in the cylinder 48 of the device 47 is a piston 49 biased in the direction of the bolt 2a of the lock by a spring 50, a sealing ring 51 ensuring a fluidtight connection between the piston and the wall of the cylinder. The piston 40 carries in its lower part a rod 52 which extends out of the cylinder device and constitutes a finger member for blocking or stopping the bolt 2a. A sealing ring 53 ensures a fluidtight connection between the rod 52 and the wall of the cylinder device through which the rod extends.

The part of the cylinder 48 located on the side of the piston adjacent the rod 52 communicates with the exterior by way of an air inlet and outlet orifice 54 the section of which is adjustable by a needle valve screw 55 and the part of the cylinder adjacent the spring 50 communicates with the exterior by way of an orifice 56.

The bolt 2a has a recess 11a similar to the recess 11 of the bolt of the lock shown in FIG. 2. However, in addition to the vertical wall 12a and inclined wall 13a, this recess 11a has an additional recess 57 adapted to ensure that the rod 52 does not block or stop displacement of the bolt immediately after the recess 11a has

been placed in front of the rod 52 so that the lock can be opened normally by means of the key provided for this purpose.

In order to describe operation of the lock shown in FIG. 1, reference will also be made to FIGS. 2 and 4.

With reference first to FIG. 4, it can be seen that in the position of rest, the switch 36 is closed so that the capacitor 45, whose two plates are connected to the positive terminal of the battery 35, is discharged. Consequently, the transistor 40 is turned off and the windings 24 and 25 surrounding the pole pieces 20 and 21 are not supplied with current. The finger member 17 is urged into the aperture 16 by the upper surface of the bolt 2 in opposition to the action of the spring 18 and closes the magnetic circuit constituted by the magnet 19 and the pole pieces 20 and 21.

Bearing in mind that most locks are so designed that the full travel of the bolt is achieved by two rotations of the key, the recess 11 of the bolt 2 is so positioned that the safety device is brought into action after one rotation of the key of the lock.

Assuming first that it is desired to unlock or open the lock by means of its key, the key being introduced in the slot 9, the key is rotated through a first turn which brings the bolt 2 to the position shown in FIG. 2.

In this position, the recess 11 is in alignment with the finger member 17 and the cam 37 actuates the micro-switch 36, the opening of which connects the capacitor to the terminals of the battery 35 (FIG. 4) through the resistors 42, 43, 44. The capacitor starts to charge, its time constant being regulated to a given value by means of the variable resistor 44.

The finger member 17 is no longer bearing against the bolt 2 but, bearing in mind that the force of the spring 18 is calculated in such manner as to be incapable of overcoming the force of attraction of the finger member 17 by the pole pieces 20 and 21, the finger member is maintained in its upper position so long as the windings 24 and 25 do not carry current.

As the first rotation of the key for opening or unlocking the lock is usually immediately followed by the second rotation thereof, the displacement of the bolt 2 produced by the second rotation of the key occurs before the capacitor is sufficiently charged to produce the energization of the windings 24 and 25.

In the course of the second displacement of the bolt, the cam 37 ceases to actuate the microswitch 36 which is closed and causes the discharge of the capacitor 45 so that the circuit shown in FIG. 4 is returned to its initial state.

Suppose now that an attempt is made to unlock or open the lock by picking it and that it has been possible to displace the bolt 2 to the position shown in FIG. 2. As described hereinbefore, the switch 36 actuated by the cam 37 opens and the capacitor 45 is charged. Bearing in mind that, even for a very clever specialist having perfectly designed tools, the opening of a lock by picking its requires much more time than the opening of the lock by means of a key, the second displacement cannot occur immediately after the first displacement of the bolt. Consequently, the capacitor 45 continues to be charged and when its charge reaches the breakdown voltage of the Zener diode 41, the latter starts to conduct and applies a signal to the base of the transistor 40 and thus energizes the windings 24 and 25.

As the directions of winding of the windings are opposite the currents therein produce fields which cancel out the magnetic field of the pole pieces 20 and 21.

As the finger member 17 is no longer attracted, it is biased downwardly by the action of the spring 18 and enters the recess 11.

In the course of an attempt to displace the bolt 2 in a direction of unlocking or opening the lock, the finger member 17 abuts the vertical wall 12 of the recess 11 and stops the displacement.

Further, the penetration of the finger member 17 in the recess 11 cuts one of the connections between the windings 24 and 25 and the connection between the emitter of the transistor 40 and the positive terminal of the battery 35, which reduces the consumption of the device.

It will be understood that it is possible for a person equipped with a key to unintentionally operate the safety device by leaving the bolt 2 too long in a stationary position between the first and second rotations of the key. To unlock the lock, it will then be necessary to return the bolt 2 to its initial closing position (rendered possible by the presence of the inclined wall 13 of the recess 11) and then once again open the lock with no delay between the two rotations of the key.

The operation of the lock shown in FIG. 5 is slightly different from that just described owing to the different construction of the safety device.

The rod 52 of the piston 49 is maintained in its upper position by the upper wall of the bolt 2a. When the lock is unlocked or opened by means of a key, the recess 11a of the bolt is brought by the first rotation of the key in alignment with the rod 53. As the latter is no longer retained by the bolt, it starts to move downwardly with the piston 49 against the action of the spring 13, the piston expelling the air contained in the lower part of the cylinder by way of the orifice 54.

The section of the orifice 54 is so adjusted by means of the needle valve 55 that the rod cannot reach a level lower than the depth of the recess 57 before the user has given the second rotation to the key so that, in the course of the second displacement of the bolt, the rod 53 is raised to its initial position by bearing in the recess 57.

On the other hand, when an attempt is made to unlock the lock by picking the lock, which necessarily takes a longer time than a normal lock opening operation with a key, the rod 52 has time to deeply penetrate the recess 11a and block subsequent displacement of the bolt 2a by bearing against the vertical wall 12a of the recess 11a.

The rearward return motion of the bolt 2a is possible, as before, owing to the presence of the inclined wall 13a of the recess 11a.

The safety devices shown in FIGS. 1 and 5 are both adjusted in such a manner that their time delay, respectively constituted by the time delay circuit 32a and the cylinder device 47, are such as to produce a blocking of the bolt 4 seconds after the recess 11 or 11a is held stationary in alignment with the finger member 17 or the rod 52. This interval of time is sufficient to ensure that the bolt is not blocked when normally opening the lock with a key.

The alarm actuating device shown in FIG. 6 is associated with the keeper 10 of the lock.

It is well known that in the course of an attempt to open a door, a specialist to which access to the prem-

ises closed by this door is normally forbidden, takes the precaution of checking that the door is actually closed by the key before trying to open the lock. For this purpose he exerts a thrust on the door so as to check whether the bolt of the lock is engaged in the keeper.

The invention provides a device which is responsive to such a thrust and is adapted to actuate an alarm bell.

For this purpose, the free space defined in the keeper 10 is employed for enclosing a first plate 60 of insulating material which is applied against the inner wall of the keeper 10 opposite its plane of application against the frame 61 of the door. The plate 60 is supported by this inner wall of the keeper 10 through two springs 62 engaged in blind apertures 63 provided in the plate and defines on its face opposed to the apertures 63 a recess 64 adapted to allow the passage of the bolt 2 of the lock.

A second plate 65 of insulating material defines a recess 66 disposed in front of the recess 64 formed in the plate 60 with which it is assembled by means of screws 67 of the keeper 10 which also act as guides for displacement of the plate 60.

The recesses 64 and 66 of the plates 60 and 65 constitute a cavity in which the bolt 2 penetrates.

Embedded in the plate 65 are two microswitches 68 and 69 which are disposed on each side of the recess 66. The push-members of the microswitches are in contact with the surface of the plate 60.

The switches 68 and 69 are connected in parallel through conductors 70 and 71 embedded in the plate 65 and conductors 72 and 73 to an alarm bell (not shown) and to its source of power.

A thrust exerted on the door causes the displacement of the plate 60 by the bolt 2 in opposition to the action of the springs 62 and 63. The push-members of the switches 68 and 69, which are normally open, are then released owing to the fact that the distance between the plate 60 and the plate 65 is increased and this closes the switches and causes actuation of the alarm bell. The bell may be supplied with power either by the mains or by an independent source of voltage, for example a battery.

The safety device shown in FIGS. 1-5 is compact so that it is adaptable to a large number of existing locks. Further, the safety device shown in FIG. 5 is equipped with an air cylinder device 47, but it is possible to employ for actuating the bolt blocking rod a hydraulic cylinder device whose piston integral with the rod is biased in the direction of the bolt of the lock by a spring. In the case of a hydraulic cylinder device, the cylinder of the device is hermetically closed. The piston of the cylinder device defines two chambers in the cylinder, these chambers communicating by way of a calibrated orifice formed in the piston so that, in the course of the displacement of the piston under the action of the spring, the passage of oil from one chamber to the other by way of the orifice displaces the blocking rod at a given speed and thus affords the time delay for blocking the bolt.

Owing to its simple construction, the device for actuating an alarm is adaptable to all locks which have a keeper the internal volume of which is sufficient to house the device.

The safety device according to the invention renders a lock with which it is equipped practically unpickable.

Further, when the case of the lock is constructed from hardened steel, and, if it concerns a barrel-type lock, the barrel is protected by the arrangement described with reference to FIG. 1, the lock is rendered practically inaccessible by picking or drilling.

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

1. A safety device for a lock comprising a case, a bolt, a keeper in which the bolt is engageable in a closing position of the lock, bolt shifting means associated with the bolt to shift the bolt a given distance out of engagement with the keeper, delayed-action blocking means for precluding displacement of the bolt in a direction for opening the lock after a predetermined interval of time and means for associating the blocking means with the bolt so that the blocking means are rendered operative by a displacement of the bolt through an initial part of said given distance by said shifting means.

2. A safety device for a lock comprising a case, a bolt, a keeper in which the bolt is engageable in a closing position of the lock, bolt shifting means associated with the bolt to shift the bolt a given distance out of engagement with the keeper, delayed-action blocking means for precluding displacement of the bolt in a direction for opening the lock after a predetermined interval of time, the blocking means comprising a recess in the bolt, a finger member which is mounted relative to the case to move transversely of the direction of displacement of the bolt between the first position out of engagement with the recess and a second position of engagement with the recess when the bolt has been displaced through an initial part of said given distance by the shifting means, an electromagnetic device associated with the finger member for maintaining the finger member out of engagement with the recess, means for ordinarily biasing the finger member to said second position, a time delay circuit associated with the electromagnetic device to cause the electromagnetic device to release the finger member after a predetermined time interval and means for bringing the time delay circuit into action when the bolt has been displaced through an initial part of said given distance.

3. A device as claimed in claim 2, comprising a block of plastics material mounted in the case, means defining an aperture in the block, the finger member being slidably mounted in the aperture, the means for biasing the finger member being a spring bearing against the finger member, the electromagnetic device being embedded in the block.

4. A device as claimed in claim 3, wherein the electromagnetic device comprises a magnet having poles, two elongate pole pieces having first end portions applied against the poles of the magnet, means for insulating said end portions from the magnet, a demagnetizing winding carried by each pole piece and connected to the time delay circuit, the pole pieces having second end portions which are insulated from each other and define faces which constitute movable parts of a wall defining said aperture.

5. A device as claimed in claim 4, wherein ends of the pole pieces remote from the aperture respectively carry connectors for connection to the time delay circuit, each of said demagnetizing windings having a terminal connected to the pole piece which carries it and an op-

posite terminal connected with the opposite terminal of the other winding to a common point insulated from the pole pieces, the pole pieces and the finger member thus constituting a switch the closure of which connects the demagnetizing windings in parallel to the time delay circuit.

6. A safety device as claimed in claim 2, wherein said means for bringing the time delay circuit into action comprise a switch having a push-member and a cam fixed to the bolt and capable of shifting the push-member of the switch.

7. A safety device as claimed in claim 6, wherein the time delay circuit comprises a transistor, said demagnetizing windings being connected to the emitter-collector terminals of the transistor through said switch constituted by the pole pieces and the finger member, and a capacitor the charging and discharging of which are controlled by said switch of said means for bringing the time delay circuit into action.

8. A safety device for a lock comprising a case, a bolt, a keeper in which the bolt is engageable in a closing position of the lock, bolt shifting means associated with the bolt to shift the bolt a given distance out of engagement with the keeper, delayed-action blocking means for precluding displacement of the bolt in a direction for opening the lock after a predetermined interval of time, the blocking means comprising a recess in the bolt, a cylinder device having a cylinder and a piston slidable in the cylinder, a rod integral with the piston and movable transversely of the direction of displacement of the bolt between a first position out of engagement with the recess and a second position of engagement with the recess when the bolt has been displaced through an initial part of said given distance by the shifting means, resiliently yieldable means associated with the piston to bias the piston in the cylinder of the cylinder device in a direction to move the rod to said second position, the cylinder device comprising means for adjusting the rate of discharge of the fluid displaced by the piston in the cylinder when moved by the resiliently yieldable means so as to produce a time delay in the blocking of the bolt by the rod.

9. A safety device as claimed in claim 8, wherein the cylinder device is an air cylinder device and the discharge rate adjusting means comprise means defining an orifice which has an adjustable section for putting the cylinder in communication with the atmosphere on a side of the piston opposed to the resiliently yieldable means.

10. A safety device as claimed in claim 8, wherein the cylinder device is a hydraulic cylinder device, the discharge rate adjusting means comprising means defining an orifice for putting two chambers defined by the piston in the cylinder in communication with each other.

11. A safety device as claimed in claim 2, wherein the recess in the bolt defines a vertical wall which constitutes an abutment when the finger member is engaged in the recess and opposes the displacement of the bolt in the direction for opening the lock, and an inclined wall constituting a ramp for permitting the displacement of the bolt in the direction for closing the lock.

12. A safety device as claimed in claim 8, wherein the recess in the bolt defines a vertical wall which constitutes an abutment when the rod is engaged in the recess and opposes the displacement of the bolt in the direction for opening the lock, and an inclined wall consti-

tuting a ramp for permitting the displacement of the bolt in the direction for closing the lock.

13. A safety device as claimed in claim 8, wherein the recess defines an additional recess to permit the displacement of the bolt in the direction for opening the lock in the course of the normal opening of the lock.

14. A lock comprising a case, a bolt movable in the case, a keeper in which the bolt is engageable in a closing position of the lock, bolt shifting means associated with the bolt to shift the bolt a given distance out of engagement with the keeper, and a safety device comprising delayed-action blocking means for precluding displacement of the bolt in a direction for opening the lock after a predetermined interval of time and means for associating the blocking means with the bolt so that the blocking means are rendered operative by a displacement of the bolt through an initial part of said given distance by said shifting means.

15. A lock as claimed in claim 14, wherein the case is of hardened steel.

16. A lock as claimed in claim 14, comprising a barrel, a sleeve of hardened steel for protecting the barrel and fixed to the case, said sleeve having an end thereof opposed to the end thereof fixed to the case an end wall defining an eccentric aperture, a member of hardened steel rotatably mounted in the eccentric aperture and defining a slot for the introduction of a key for actuating the lock.

17. A lock for a door in a door structure and including a bolt, means for shifting the bolt, and a keeper in which the bolt is engaged in the closing position of the lock, said lock comprising, mounted in the keeper, a device for actuating an alarm responsive to a thrust exerted on the door of the door structure when the bolt of the lock is engaged in the keeper.

18. A lock as claimed in claim 17, wherein the door structure has a frame and the alarm-actuating device comprises a first plate of plastics material which is movably mounted adjacent an inner wall of the keeper opposed to a part of the keeper adapted to be secured to the frame of the door structure, resiliently yieldable means for biasing the first plate away from said inner wall of the keeper, the first plate being capable of being displaced by the bolt in opposition to the action of the resiliently yieldable means, and a second plate of plastics material mounted between the first plate and said part of the keeper adapted to be secured to the frame of the door structure, a switch capable of being closed by displacement of the first plate with respect to the second plate, an electric alarm device and a circuit for supplying current to the alarm device, said switch being inserted in said circuit.

19. A lock as claimed in claim 18, wherein each of said plates defines a recess, said recesses constituting a cavity for receiving the bolt of the lock.

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