Nov. 5, 1968 J. H. KATZ 3,408,838

ELECTRIC DOOR LOCK

Original Filed Oct. 21, 1965 2 Sheets-Sheet 1

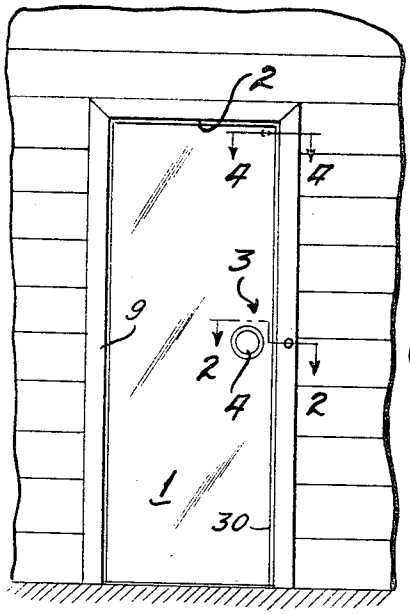


FIG. 1

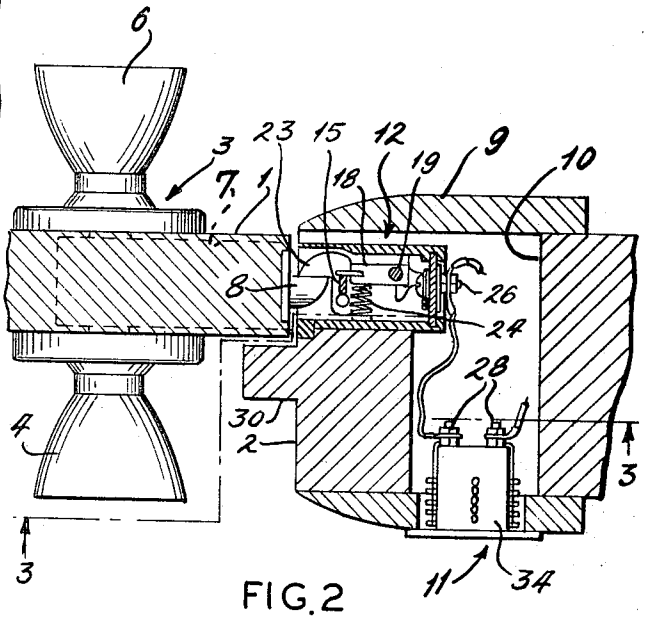


FIG. 2

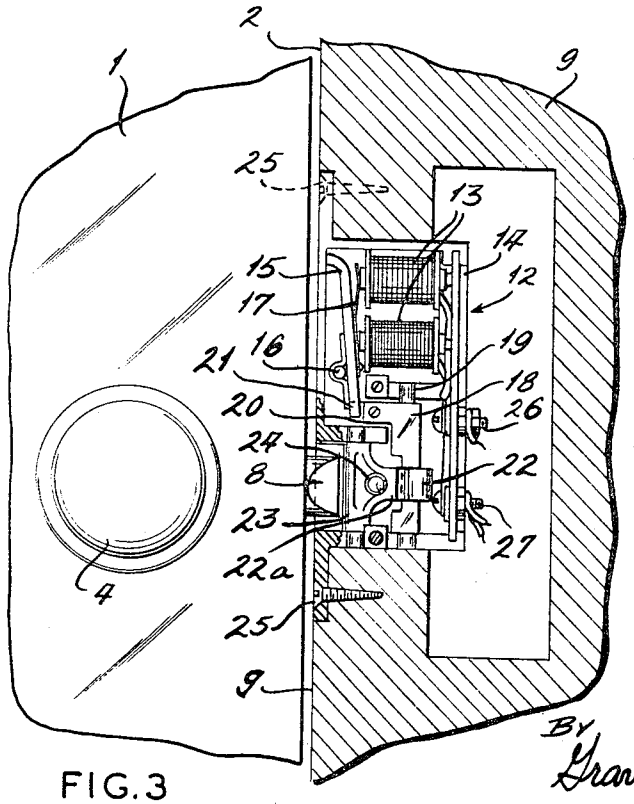


FIG. 3

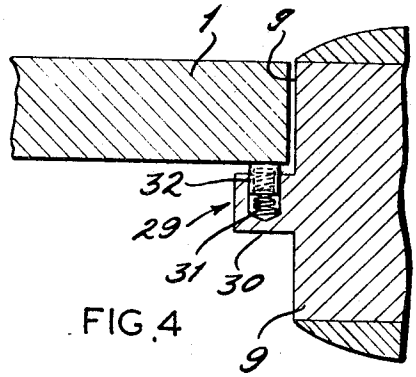


FIG. 4

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ELECTRIC DOOR LOCK

Original Filed Oct. 21, 1965 2 Sheets-Sheet 2

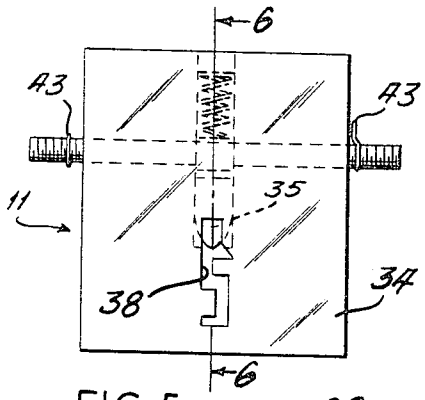


FIG. 5

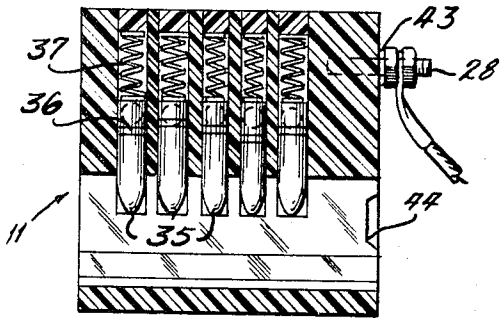


FIG. 6

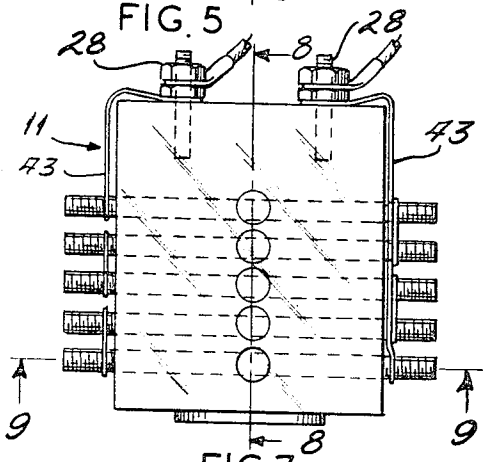


FIG. 7

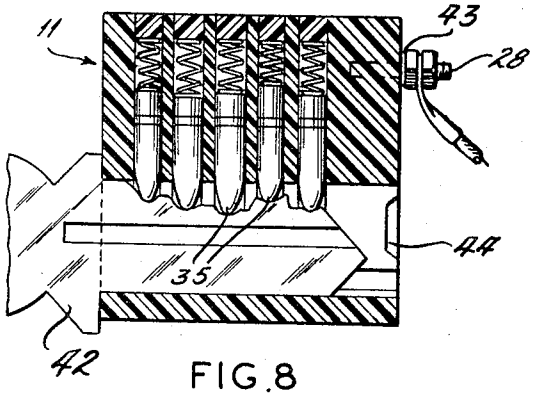


FIG. 8

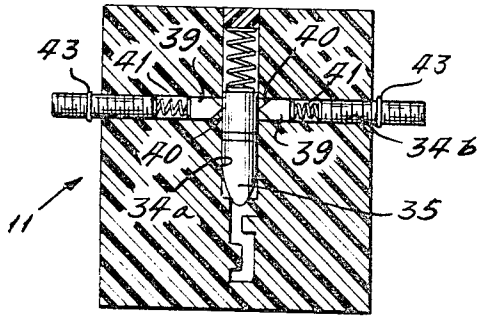


FIG. 9

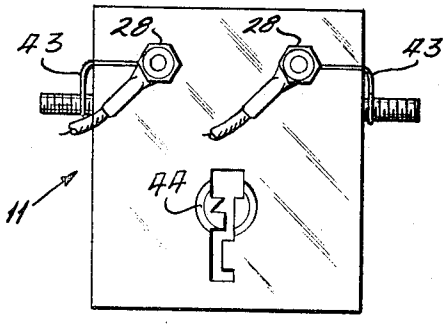


FIG. 10

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ELECTRIC DOOR LOCK

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Continuation of application Ser. No. 499,674, Oct. 21, 1965. This application Oct. 24, 1967, Ser. No. 677,787

8 Claims. (Cl. 70—277)

ABSTRACT OF THE DISCLOSURE

An electric lock device for controlling voltage flow to a latch mechanism including an insulated housing having a series of aligned electrically non-conducting tumbler pins positioned in openings in the housing and projected into a keyway so that the pins are displaced when a key is inserted into the keyway. The pins are provided with conducting portions of the same diameter as the adjacent non-conducting portions to make the lock pick-proof. When the key is inserted into the keyway the conducting portions of the pins are aligned with opposed transverse openings communicating with the pin openings. In the openings are opposed conducting members having knife-edge contact points engaging the pin and contact extensions connected in series to the latch coils, so that when a key is inserted into the keyway, a series circuit is established through the lock and actuates the latch coil.

This is a continuation of application Ser. No. 499,674, filed Oct. 21, 1965, now abandoned.

This invention relates to an electric door lock, and more particularly to an electric door lock having a tumbler mechanism operating as an activator switch.

Various electrical locks have been proposed in the past which operate on insertion of a key into the barrel of the tumbler mechanism and rotation of the key (as in a conventional mechanical lock) to make an electrical contact which releases or operates the lock-mechanism to the unlock position. Generally, such electrical locks have tumbler mechanisms which operate under the same principles as a mechanical lock. Thus, on insertion of a key, the tumbler pins are aligned such that the entire tumbler barrel may be rotated relative to its outer casing to make an electrical contact rather than mechanically moving a locking lug. The closing of the electrical switch supplies power to a solenoid or relay to release the locking lug. One of the difficulties with the usual tumbler mechanism is that, for a person familiar with such devices, it is relatively easy to determine if each individual tumbler is in the proper position for rotation of the tumbler mechanism, and therefore such a tumbler lock can be readily picked by aligning the tumbler pins one at a time.

The present invention provides a device which overcomes the aforementioned difficulties encountered in conventional tumbler mechanisms which are employed to operate as a switch in electrical locks and which further substantially circumvents lock picking or any method of activating the lock switch such as liquid flooding, etc.

Briefly, the present invention contemplates an electric circuit which employs a special tumbler mechanism. The tumbler mechanism is designed to operate as an electrical switch to complete the locking latch circuit on insertion of a proper key. The tumbler mechanism employs solid tumbler pins of an insulating material which have electrically conductive bands such that, on insertion of a key properly encoded for the tumbler mechanism, each tumbler band will be aligned with contacts engaging the electrically conductive bands. Each tumbler is connected electrically in series with the next tumbler through the wiring

of the contacts and the electrically conductive bands on the tumbler pins. Only when the tumbler pins are each aligned with their contacts will the electrical circuit be completed by the tumbler mechanism.

It will be appreciated that the tumbler mechanism does not require rotation to activate the electrical circuit. Consequently, the invention eliminates the two piece tumblers normally used and prevents the tumblers from being aligned one at a time.

Inasmuch as each individual tumbler pin is made of one piece of material it is not possible to determine when the tumbler is aligned with its contacts engaging the electrically conductive band therearound, and consequently it is practically impossible to pick the tumblers to activate the electric lock. Moreover, the key slot in the barrel is open at both ends such that any attempt to flood the key slot with a conductive fluid will be unsuccessful as the fluid being pumped into the key slot will drain out at the identical rate that it is applied into the lock.

It is therefore an object of the invention to provide an electrical lock having a stationary tumbler barrel which is simple and easy to construct yet is extremely difficult to pick.

It is another object of the invention to provide an electrical door lock having a stationary barrel tumbler mechanism which is activated by insertion of a key in the key slot of the barrel so long as the key properly aligns the tumblers.

It is another object of the invention to provide an electrical lock which has a stationary tumbler barrel having a series of tumblers which are aligned by a key wherein each tumbler is electrically sequentially connected to complete an electrical door unlocking circuit.

It is another object of the invention to provide an electrical lock having a stationary tumbler barrel and a series of tumblers having conductive bands which are aligned on insertion of a properly oriented key in the tumbler barrel to sequentially complete an electrical circuit that operates the lock.

A further object of the present invention is to provide an electrical lock which can have different tumbler combinations encoded thereon by the repositioning of conductive rings on the tumblers and the use of knife edge contact points.

It is another object of the invention to provide a door with an electrical lock which includes a stationary barrel and a series of tumblers which activate an electric circuit to release the lock when the tumblers are properly aligned.

Still another object is to provide a one piece insulating block for an electric lock with no rotatable barrel whereby manufacture is facilitated, with the key slot being formed directly in the block which houses the tumblers and electrical conduits.

These and other objects and advantages of the invention will become apparent to those skilled in the art from the ensuing description taken in conjunction with the appended claims and the drawings wherein:

FIG. 1 is a fragmentary elevational view illustrating a door incorporating the invention;

FIG. 2 is a cross sectional view taken along the line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 in FIG. 1 which illustrates the self-opening feature of the door;

FIG. 5 is an enlarged front view of the tumbler mechanism appertaining to the invention;

FIG. 6 is a sectional view taken along the line 6—6 in FIG. 5;

FIG. 7 is a top view of the tumbler mechanism illustrated in FIG. 5;

FIG. 8 is a cross sectional view taken along the line 8—8 in FIG. 7 illustrating a key properly aligning the tumblers;

FIG. 9 is a sectional view taken along the line 9—9 in FIG. 7; and

FIG. 10 is a rear view of the block.

Referring to the drawings and in particular FIGS. 1–4, a door **1** is mounted in a doorway **2**. A door closure **3** having an outside knob **4** and inside knob **6** is secured within a door recess or mortice **7** (shown in phantom). The door closure **3** has a retractable latch **8** which may be operated by the inside handle **6**, and the outside knob **4** whenever the latch lock (not shown) for knob **6** is in the unlocked position. The door frame **9** of doorway **2** has a recess or mortice **10**. A tumbler mechanism **11**, hereinafter discussed in detail, is mounted to the doorframe **9** with the key recess and tumbler barrel mounted for access with a key to the outside of the door frame **9**. A locking latch mechanism, generally designated **12**, is mounted in mortice **10**. Although the eletric latch mechanism may be any of the conventional designs, as illustrated a conventional mechanism includes a pair of electromagnetic coils **13** mounted in a casting **14**. A locking bar **15** is pivoted on a pin **16** of the casting **14**. The locking bar **15** includes a spring **17** to maintain the locking bar **15** biased away from the electromagnetic coils **13**. A pivotal locking latch **18** is supported by bearings **19** in the casting **14**. The locking latch **18** has a foot **20** extending under an end **21** of the locking bar **15** which prevents the locking latch **18** from pivoting unless the locking bar **15** is pivoted to a position where the end **21** is off the foot **20**. The locking latch **18** has a stop **22** which engages a tongue **22***a* on a pivotal door latch **23** and prevents the door latch **23** from pivoting unless the locking latch **18** is free to pivot. A spring **24** yieldably urges the door latch **23** to return to the locked position. The entire casting **14** which houses the door locking mechanism **12**, is secured in the mortice **10** by screws **25**. The electromagnetic coils **13** have a binding post **26** which is connected to one side of a power source (which preferably is a step-down transformer similar to those conventionally used in doorbell circuits), and a binding post **27** which is connected to one of the binding posts **28** on the tumbler mechanism **11**. The other binding post **28** on the tumbler mechanism **11** is connected to the other side of the power source. With this arrangement, when a properly coded key is inserted in the tumbler mechanism **11**, the tumblers complete an electrical circuit through the tumbler pins of the tumbler mechanism **11** between the binding posts **28** and activate the electromagnetic coils **13**. The coils **13** attract the locking bar **15** which pivots to free the locking latch **18** for rotation and consequently frees the latch **23**, and permits the door **1** to be opened by a force overcoming the biasing force of the spring **24**.

Another desirable feature utilized in conjunction with door **1** (FIG. 4) is a self-opening mechanism **29** which includes a projection **30** from the door frame **9** which has a recess **31** therein facing toward the face of the door **1** at the top corner. The mechanism includes a spring loaded plunger **32** which stores sufficient energy when the door is in the closed and locked position so that whenever a key is inserted in tumbler mechanism **11** to activate the electromagnetic coils **13** and free the door latch **23**, the force of the spring loaded plunger **32** is sufficient to overcome the force of the biasing spring **24** and cause the door **1** to automatically open.

Referring now to FIGURES 5–9, the unique tumbler mechanism **11** will be described in detail. The tumbler mechanism **11** includes a one piece insulating block **34** which is provided with openings for a key, tumblers, and electrical contacts as will be explained in more detail hereinafter. This construction eliminates the conventional barrel. The block **34** has a series of tumbler pins **35** mounted in openings **34***a*. The pins **35** are made of a one piece insulating material and each includes a conductive ring **36**. Each tumbler **35** has a spring **37** biasing the tumbler into the key slot **38** provided in the block **34**. Each tumbler pin **35** has a pair of contact pins **39** including a knife edge **40** and a biasing spring **41**. The contact pins **39** are mounted in openings **34***b* in the block **34** adjacent to the opposed sides of each of the tumbler pins **35** and are mounted in the block **34** transverse to the tumblers **35**. The edges or wipers **40** are biased into engagement with the tumbler pins **35** by springs **41**. The conductive rings **36** on the pins **35** are arranged at varying distances from the end of each pin **35**, so that whenever a key **42** is inserted into the key slot **38** (also formed integrally in the block **34**), the tumbler pins **35** will be positioned with the conductive ring **36** in engagement with the edges **40** and thus provides electrical continuity between each pair of contact pins **39** and the associated tumbler pins **35**. The contact pins **39** are serially connected by suitable wire **43** to provide the equivalent of an electrical circuit with five serial switches all of which must be closed to complete the electrical circuit through the tumbler mechanism **11** between the binding posts **28**. To avoid the possibility of the tumbler mechanism being shorted to the contact pins by flooding the tumbler barrel with a conductive fluid, a tapered slot **44** is provided from the key slot **38** through the end of the tumbler mechanism **11**. The slot **44** is of sufficient size to prevent flooding of the tumbler mechanism.

To change the combination the positions of the rings **36** are changed. The knife edge contacts **40** allow the maximum number of ring positions on the tumblers **35**.

If there are 10 positions for the contact, that number to power of the number of tumblers gives the possible combination changes. As shown it would be 10^5 or 100,000 possible combinations for each key blank.

From the foregoing, it will be appreciated that an electric door lock has been described which merely requires the insertion of a proper key to sequentially complete tumbler contacts and activate the electrical mechanism to unlock the door. Moreover, it will be appreciated that the tumbler mechanism is free from tampering and cannot be picked because it is impossible to determine when a tumbler pin as been aligned with the conductive band adjacent and in engagement with its respective pair of contact pins. Furthermore, it will be appreciated that the tumbler mechanism is protected from tampering by flooding the key slot with a conductive solution, since the entry rate and exit rate of such solution would be substantially the same.

While the tumblers have been shown as being serially wired, other wirings can be used depending on the use to which the device is to be put. For example, if the device is to be used to identify keys for time clock purposes, each key would activate a different pair of tumblers to identify the key.

For a master key, a second set of rings would be used on the tumblers to close the circuit.

It will be appreciated that various changes and modifications to the door locking mechanism appertaining to the invention will be readily appreciated by those skilled in the art and all such changes and modifications are deemed to be within the scope of the invention which is defined by the appended claims.

What is claimed is:

1. An electric lock device comprising:

(a) an electrically insulated housing,

(b) a non-rotatable key slot provided in the housing,

(c) said housing having tumbler bores for housing tumbler pins, said bores being of uniform diameter as is conventional, tumbler pins movable in said bores and having portions projecting into the key slot, said tumblers being each of uniform diameter as is also conventional for vertical movement in said bores,

(d) resilient means urging the pins toward the key slot,

said tumbler pins being movable by a bitted key inserted in the key slot against the pressure of said resilient means, said pins having each an electrically controlling portion on the outer surface thereof within said bores and intermediate the length of each pin, with the position of said portion functioning as the equivalent of the length of a conventional pin tumbler,

(e) electrical contact means positioned in the housing for engaging the tumbler pins through small openings formed in the sides of said bores,

(f) said pins being positioned by a properly bitted key inserted into the key slot so that said controlling portions are opposite said openings for coaction with said contact means,

(g) locking means, and an electric control for said locking means controlled by the relative positions of said controlling portions of said tumblers and said openings in the tumbler bores.

2. An electric lock device comprising:

(a) an electrically insulated housing,

(b) a non-rotatable key slot provided in the housing,

(c) at least two movable tumbler pins mounted in the housing and projecting into the key slot,

(d) resillient means urging the pins toward the key slot, said tumbler pins being movable by a key inserted in the key slot, said pins having an electrically conducting portion on the outer surface thereof, said conducting portion being of the same diameter as the outer diameters of the adjacent portions of the pins,

(e) electrical contact means positioned in the housing and aligned with and engaging the tumbler pins, the contact means having substantially pointlike contact with the tumbler pins,

(f) said pins and said electrical contact means being aligned when the key is inserted into the key slot to establish a circuit through the lock,

(g) and an electrically actuated door latch including a coil connected in series with the lock so that establishment of the circuit through the lock energizes the coil and releases the door latch.

3. The device of claim 2 wherein the pins are series connected by the contact means so that all of the pin conducting portions must be electrically connected before the lock circuit is established.

4. The structure of claim 3 wherein the conducting portions are positioned at vertically spaced positions on the pins.

5. The device of claim 2 wherein the contact means extend transversely from opposed sides of the pins and are series connected to thereby series connect the pins.

6. The device of claim 5 wherein the contact means include rods threaded into the sides of the housing and extending outwardly from the housing, pin engaging members and conducting resillient means interposed between the pin engaging members and the rod ends within the housing.

7. The device of claim 2 including means urging the contact means into engagement with the pins.

8. The device of claim 7 including a pair of opposed contact means adjacent to each pin.

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