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Ewing

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[54] **ELECTRICALLY OPERATED TWO POSITION ELECTROMECHANICAL MECHANISM**

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[51] **Int. Cl.** **E05b 47/02,** H01f 7/16

[58] **Field of Search** 292/144, 201; 335/253, 254; 74/126

[56] **References Cited**

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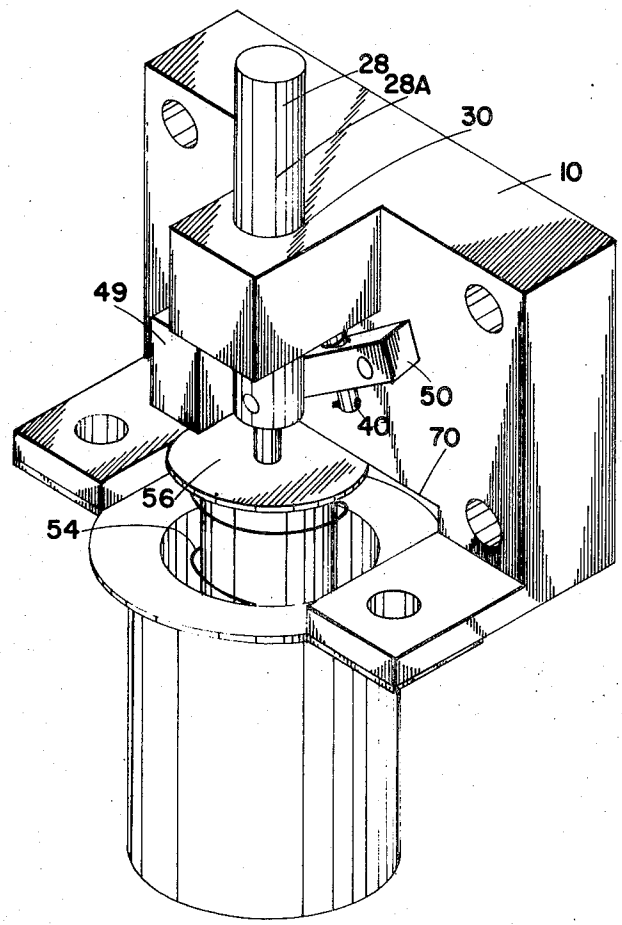
Primary Examiner—Albert G. Craig, Jr.

[57] **ABSTRACT**

An electrical type of lock wherein the mechanical movement is actuated in response to a solenoid system triggered by an electrical momentary signal. The locking bolt alternatively changes from a locking to unlocking position or vice versa in a snap action and is retained in its respective position. The bolt is modified by mechanical means in association with the solenoid.

The locking arrangement and its actuation circuitry is particularly adaptable to a system wherein the initiating voltage is transmitted via communication lines i.e., telephone lines from a remotely located control station.

6 Claims, 3 Drawing Figures



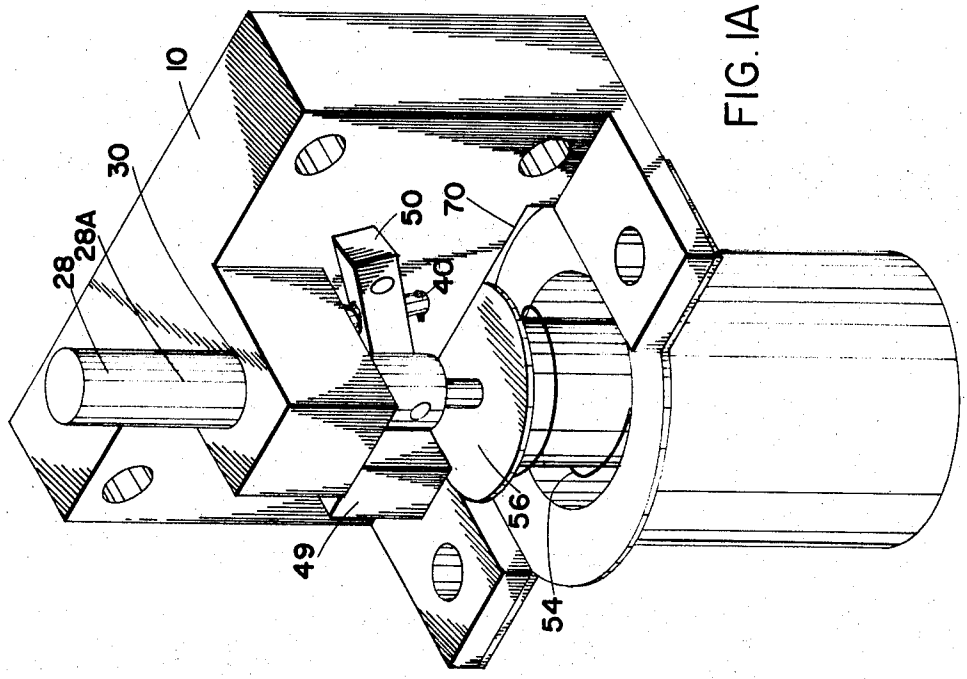


FIG. IA

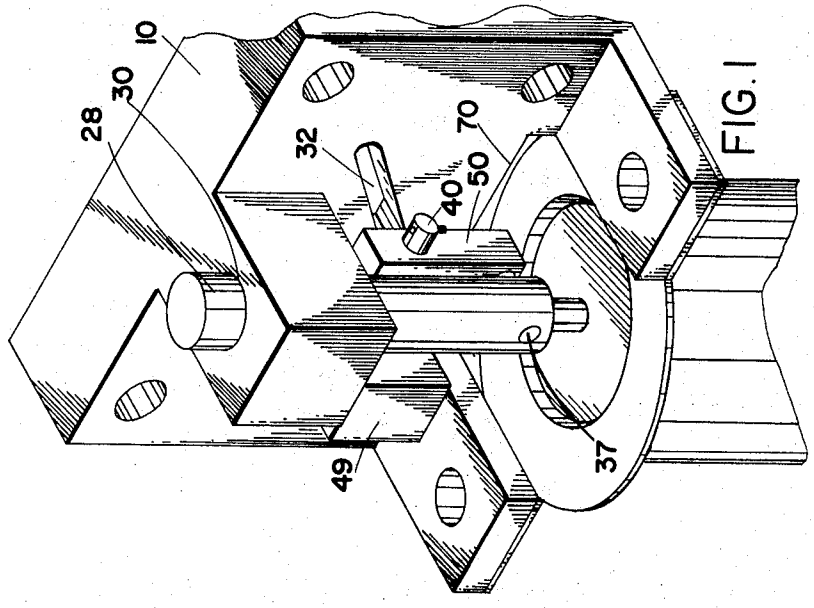


FIG. I

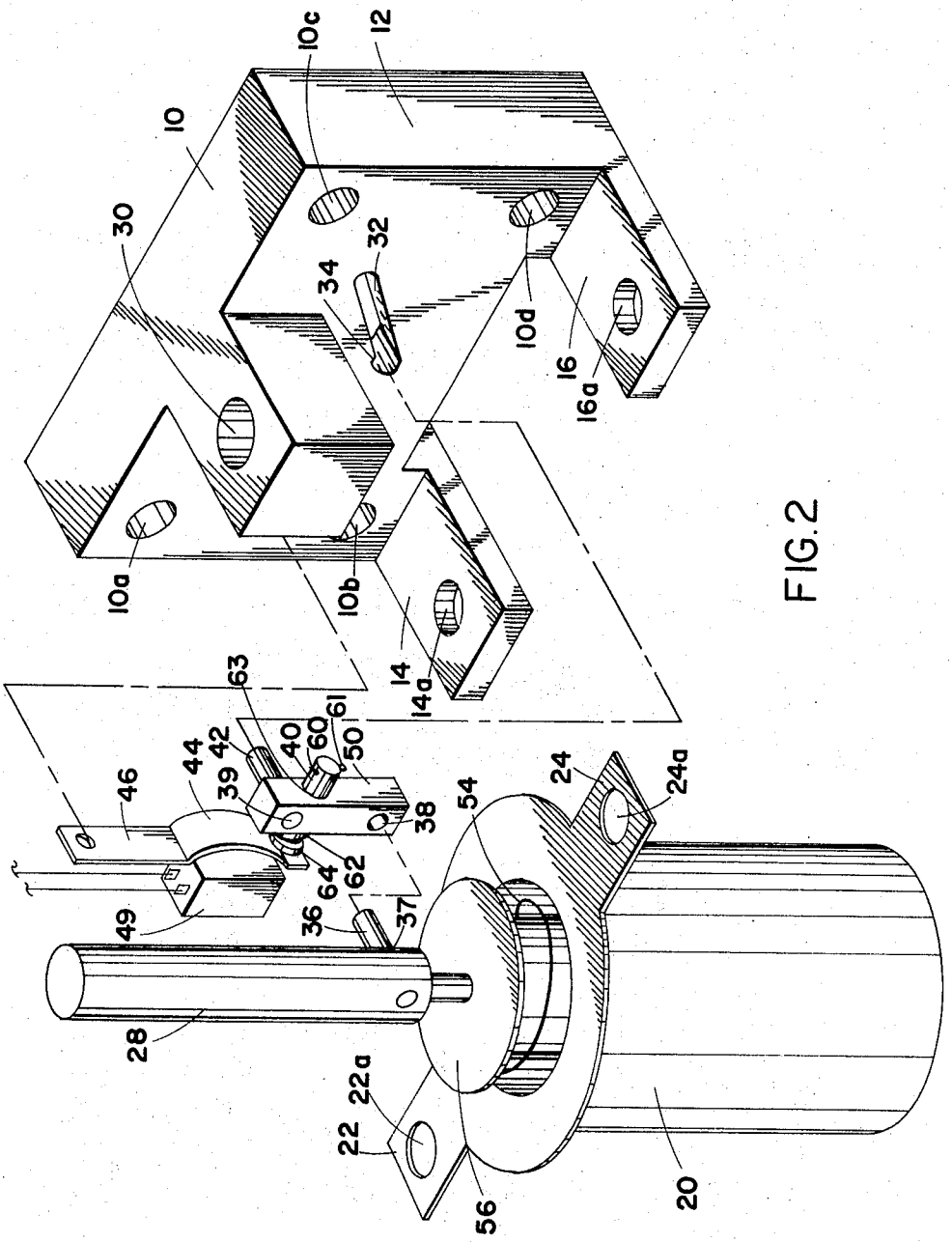

10c
12
10
30
32
34
10d
16
16a
10a
10b
14
14a
63
61
60
40
42
44
50
46
39
38
54
24
24a
62
64
49
36
37
28
22a
22
56
20

FIG. 2

ELECTRICALLY OPERATED TWO POSITION ELECTROMECHANICAL MECHANISM

CROSS REFERENCE

Reference is made to my co-pending patent application Ser. No. 316,078 for "Closed Loop Communication Wire system," filed Dec. 18, 1972; and to my co-pending patent application Ser. No. 316,091 for "Electric Strike Operable From A Remote Control Station," filed Dec. 18, 1972.

In the first reference application a direct current voltage is transmitted from a control station via communication lines to a plurality of remote stations wherein it is desired to control the movement of a mechanical device, switch, or electrical component.

The direct current voltage is accumulated in a storage circuit and then applied momentarily to the electrical component. The system is particularly described in conjunction with a solenoid operated door lock. A switch activated by the position of the door controls a signal generator in repetition rate. The indicative signals are returned via same telephone lines to the control station.

In the second referenced application a mechanical locking arrangement is described operable upon the actuation of a relay. The simplified circuitry described therewith makes that lock particularly adaptable to most doors.

BACKGROUND

Prior art door locks of the solenoid and the electric strike type achieve the lock or unlock position by either energizing or de-energizing a coil or solenoid. A few utilize two coils or solenoids — one to unlock, the other to lock. In the case of energize, de-energize, the coil or solenoid must be designed for continuous duty. This generally means the use of more copper, better insulation and provision for heat dissipation. The use of two coils or solenoids duplicates that expense and that of wiring and control circuits. None of the prior art solenoid type locks are suitable for use without local power and most are not sufficiently rugged or secure that they cannot be tampered or moved by hand.

None result in the lock shifting from the lock to unlock position and vice versa with momentary energization of a single coil or solenoid — an important requirement if the lock is to be operated remotely with a simple circuit not requiring local power.

SUMMARY OF INVENTION

The electric bolt of the preferred embodiment basically comprises a solenoid and a core operable in a single snap direction in response to the solenoid being momentarily energized. The bolt attached to the core is retained in a first position by a spring. Upon energization of the coil with a first pulse, the core and bolt are retracted by the coils magnetic field — overcoming the spring tension. Apparatus fixedly positions the bolt and retains the bolt in its retracted position. Upon the application of a succeeding pulse, kinetic storage means releases the fixed position of the bolt to permit the spring to return the bolt to its extended position. Circuitry is provided to energize the coil with power substantially greater than that normally transmitted via communication wires. In this way the lock is a two step function for alternatively locking and unlocking in a snap action upon momentary energization of the coil.

The lock finds particular utility in a system for locking and unlocking a heavy or large type of enclosure at a local station in response to a control signal from a control station transmitted via the communication lines.

OBJECTS

It is accordingly a principal object of the present invention to to provide a new and improved electrical solenoid type of lock.

Another object of the invention is to provide an electrical solenoid lock alternatively responsive to an electrical signal of only a momentary duration.

Another object of the invention is to provide an electrical solenoid lock having a positive snap action.

Another object of the invention is to provide an electrical bolt type lock having a minimum number of components operable together in a rugged and reliable manner.

Still another object is to provide a remotely operable lock having a simplified storage and control circuit, not necessarily requiring a "metallic" connection to the remote control center and not requiring local power.

Other objects and features of the present invention will become apparent from the following detailed description when taken in conjunction with

FIG. 1 and 1A of the drawing showing in cross section the solenoid lock with the improvements of the present invention in a preferred embodiment; and

FIG. 2 illustrating schematically the simplified structure of the solenoid lock of the present invention.

DETAILED DESCRIPTION OF THE DRAWING

In the aforementioned co-pending patent application there is shown and described a closed-loop system for activating a lock in a local station from a control station over the telephone lines. Particularly a direct current voltage is transmitted via the line to the local station. The voltage is permitted to accumulate and then actuates the lock in response to a control signal. The system further provides for sensing the position of a switch to determine whether the lock is locked or unlocked, another switch to determine if the door is open or closed and other perimeter protection switches located on other doors, windows, etc. The switches are used in tuning circuits to generate condition signals in the nature of oscillatory signals indicative of which switch was activated. These signals are returned to the control station via the same communication line.

With particular reference to the electrically actuated solenoid lock of FIGS. 1 and 1A, bolt **28** is slidably moveable in the opening **30** in the housing **10.** The bolt **28** has a part **28***a* that is urged to protrude from the opening **30** by the action of spring **54.** The bolt **28** protruding from the opening **30** is the bolt that would enter its female counter part in a door or enclosure for securing.

The housing **10** is best illustrated in the expanded view of FIG. **2.** The housing **10** — which actually is a support member — is shown in its upright position. In this position the lock would be adapted to bolt close an enclosure from its underside, although it can be used in any position. The housing **10** has in its main back side portion **12** several apertures **10***a*, **10***b*, **10***c*, and **10***d* for securing the structure in position. A pair A pair of right angle arms **14** and **16** also have a pair of apertures **14***a* and **16***a* aligned to receive and fixedly position the sole-

noid casing **20**. That is, solenoid casing **20** has an upper portion with a pair of ears **22** and **24** — also having apertures **22***a* and **24***a*. The center-to-center distance between the apertures **22***a* and **24***a* is identical the distance between the apertures **14***a* and **16***a*. In this way the solenoid housing **20** is fixedly positioned onto the structure **12** as shown in FIGS. **1** and **1**A.

In the conventional operation of a solenoid/bolt type of lock applying power to the coil of the solenoid will cause the bolt (core) to retract. The bolt is maintained therein so long as power is applied. Upon removing the power from the coil the magnetic forces are removed — the bolt's position is overcome by the forces of a spring. In essence then the power maintains the bolt in a first position and the spring in the second position.

It can be appreciated that if the solenoid and bolt are of a substantial size and large amount of power is needed to maintain energization of the coil. Also in the "locked" position to tamper with the lock it is necessary only to overcome the forces of the spring.

In the preferred embodiment of the present invention the bolt position is obtained by a burst or momentary application of power; and the position is maintained by a mechanical locking arrangement. This reduces the power requirements considerably and makes the lock operable from a low power source as described in my co-pending application, supra, and allows the use of a larger spring substantially eliminating tampering.

The preferred embodiment of the present invention is shown in part-per-part in FIG. **2** and in an unlocked position in FIG. **1** and locked position in FIG. **1**A.

The solenoid in the present invention, as stated above, is operable from a momentary application of power. More specifically the power applied to the coil of the solenoid is in the nature of a pulse. Continuous power is not applied in either position. A pulse is applied to activate the solenoid to retract the bolt and a pulse is applied to again activate the solenoid to release the bolt.

With particular reference now to the figures, link **50** has a lower aperture **38** adapted to slidably receive pin **36**. A second aperture **39** has pressed fitted therein pin **42**. The other end of pin **36** is pressed fitted into aperture **37** in the bolt **28**. This pin also serves to connect the bolt to the solenoid core. The other end of pin **42** is positioned in the elongated groove **32**. This groove is formed in the upright portion **12** of the structure **10**. Its width is somewhat greater than the diameter of the pin **42** to permit sliding therein without disengagement. The groove at its lower most end has a "flat" **34** formed therein to permit the pin **42** to be seated and retained therein. This flat is perpendicular to bolt **28**.

The lock (bolt **28**) in its open (retracted) position has pin **42** seated in the flat **34**. In the closed (extended) position of the lock (bolt **28**) the pin **42** is positioned in the upper region of the slot **32**. Also in the extended position the forward travel of the core is stopped by the contact of solenoid coil plate **56** and the housing at **70**.

A bar type of spring **46** having an arc portion **44**, shown in FIG. **2**, is positioned on the upright portion of the structure **10** adjacent to the link **50**. That is, cross pin **40** in link **50** contacts the arc portion **44** of spring **46**.

In operation a pulse applied actuates the solenoid which in turn retracts the bolt **28**. As the bolt **28** is retracted link **50** assumes an upright position as shown in FIGS. **1** and **2**. The pin **6** positioned in aperture **38** forces the lower end downward. The pin **42** is forced into the flat end **34** of the elongated groove **32**. Although the power applied is only momentary, the bolt **28** will stay retracted since it is locked into position by the pin **42** in the end **34** of the groove **32**.

At the same time the arc portion of the spring **46** is forced to the left and thereby put into tension. Pin **40** is moveably mounted in link **50** and is retained on one end by head **64** which also serves to contact the arc portion **44** of spring **46**. Pin **40** is retained on the opposite end by pin **61** press fitted into aperture **60**. A small spring **62** urges pin **40** to the left. In the final stage of retraction, the kinetic energy of link **50**, pin **42** and pin **40** are absorbed by springs **46** and **62**. Spring **54** opposes retraction and immediately following complete retraction reverses the direction of bolt movement and causes link **50** to move slightly upward to cause pin **42** to contact end **34** of groove **32**. The bolt **28** is now held in the retracted position by the force of spring **54** causing contact between pin **42** and end **34** of groove **32**.

To actuate the bolt to a door lock position a second pulse is applied to again energize the coil of the solenoid **20**. The bolt already retracted, will retract only enough to relieve the contact pressure between pin **42** and end **34** of groove **32**. As no kinetic energy is developed by pin **40**, link **50** and pin **42** pivoting about pin **36**; as was previously the case, the kinetic energy stored in springs **46** and **62** causes the link **50** to pivot in a clockwise direction. The spring **54** now causes the bolt to extend as pin **42** travels freely upwards in slot **32**.

The spring **54** is fixed at its lower end to the casing **20** and at its upper end to plate **56** fixed to a movable portion of the solenoid.

Microswitch **49** contacts movable solenoid core plate **56** to detect and transmit locked or unlocked position, as described in my co-pending patent applications, supra.

Although certain and specific embodiments have been described and illustrated it is to be specifically understood that modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrically operated two position electromechanical mechanism including a solenoid having a core therein and a spring for urging said core outwardly, the improvement comprising; a means for applying a first electrical power pulse to said solenoid to retract said core, and structure moveably connected to said core to retain said core in its retracted position upon removal of said pulse; kinetic energy storage means also connected to said structure means, means of applying a second power pulse to said solenoid to thereby release said kinetic energy and thereby release said core from said retained position, and whereby said spring tension returns said core to its outwardly position.

2. The electrically operated mechanism of claim **1** wherein said two position electromechanical mechanism is a locking and releasing mechanism.

3. The electrically operated mechanism of claim **1** wherein said structure is a link having an upper and lower pin and a housing for supporting said mechanism, said pin interconnecting said core to said housing.

4. The electrically operated mechanism of claim **2** wherein said housing has an elongated slot formed therein and said upper pin is positioned in said slot.

5. The electrically operated mechanism of claim **3** wherein said slot in said housing further includes a portion adapted to receive and retain said pin in position.

6. The electrically operated mechanism of claim **1** wherein said kinetic energy storage means is a bar type of spring.

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