United States Patent [19]

Castle

[11] **3,751,949**

[45] **Aug. 14, 1973**

[54] **LOCKING DEVICE**

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[22] Filed: **Oct. 1, 1971**

[21] Appl. No.: **185,575**

[52] **U.S. Cl.** **70/144,** 70/393, 292/36, 292/65, 292/66, 292/169.14, 292/173

[51] **Int. Cl.** **E05c 1/12**

[58] **Field of Search** 70/118, 119, 120, 70/125, 127, 144, 150, 162, 169; 292/6, 7, 36, 65, 66, 67

[56] **References Cited**

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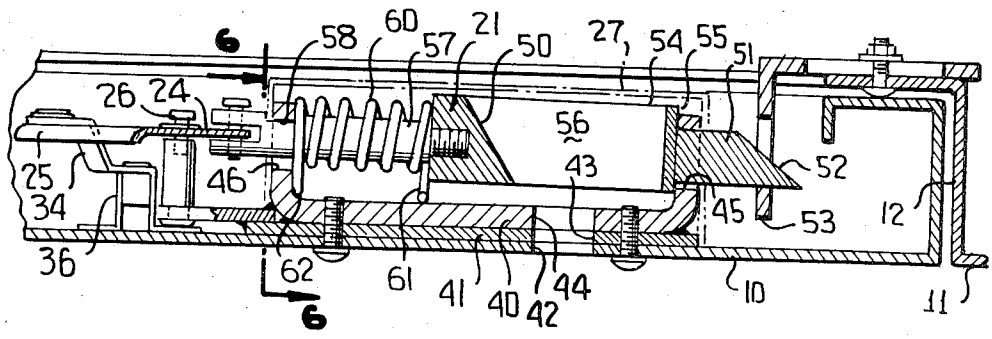
Attorney—Ira C. Edell et al.

[57] **ABSTRACT**

The lock includes a spring projected, tool retracted, closure carried, sliding bolt which is improved by providing a cross-channel in the sliding bolt and opening the ends of the helical compression spring surrounding the bolt. The open spring ends form feet which urge the bolt away from its support bracket and force the channel into engagement with the lock housing to prevent longitudinal movement of the bolt. The lock is also arranged to actuate a pivot arm which controls the sliding movement of two secondary bolts to provide a three-point locking device.

9 Claims, 7 Drawing Figures



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SHEET 1 OF 2

FIG. 2

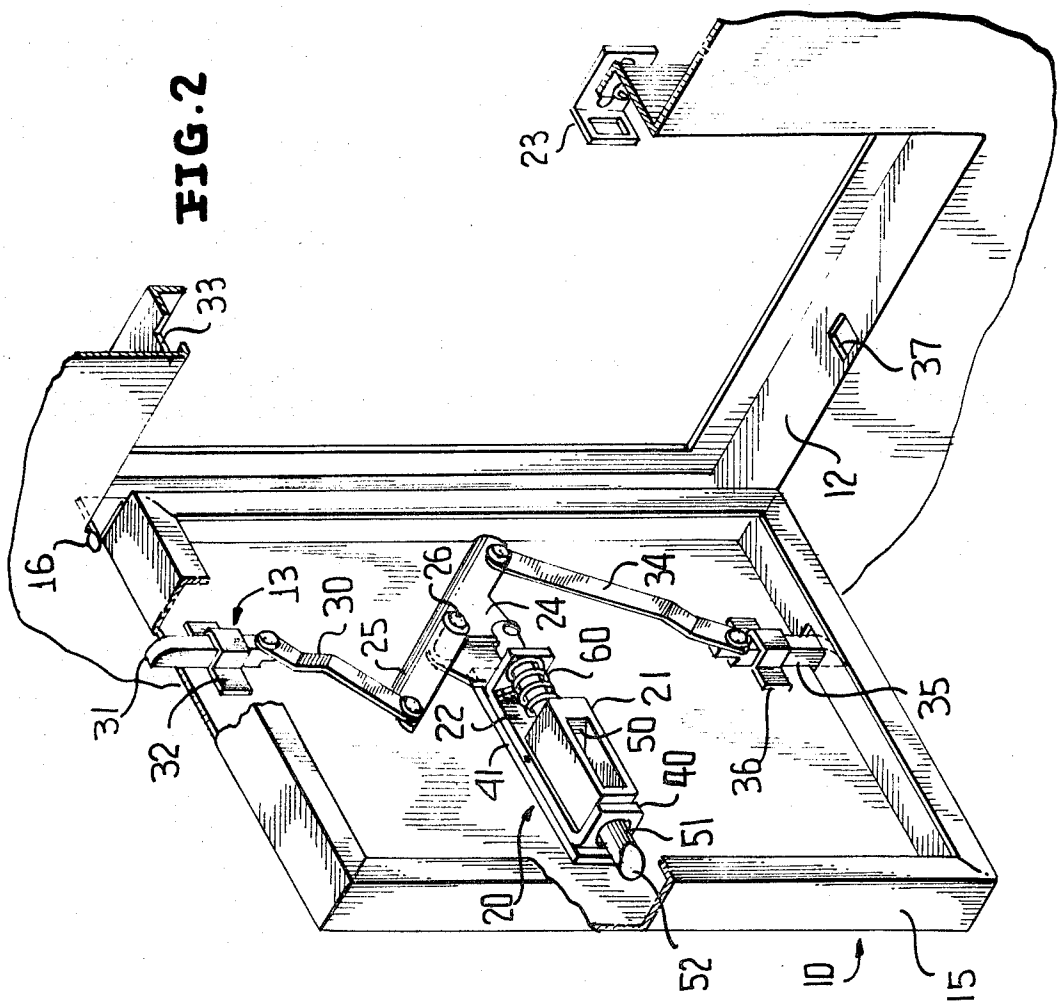
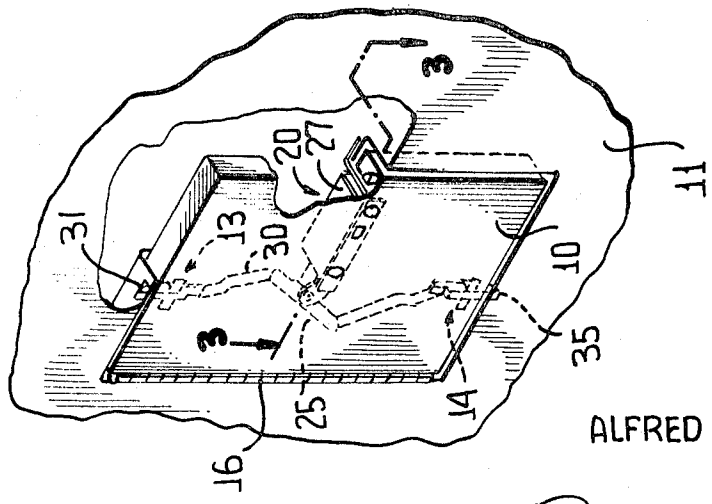


FIG. 1



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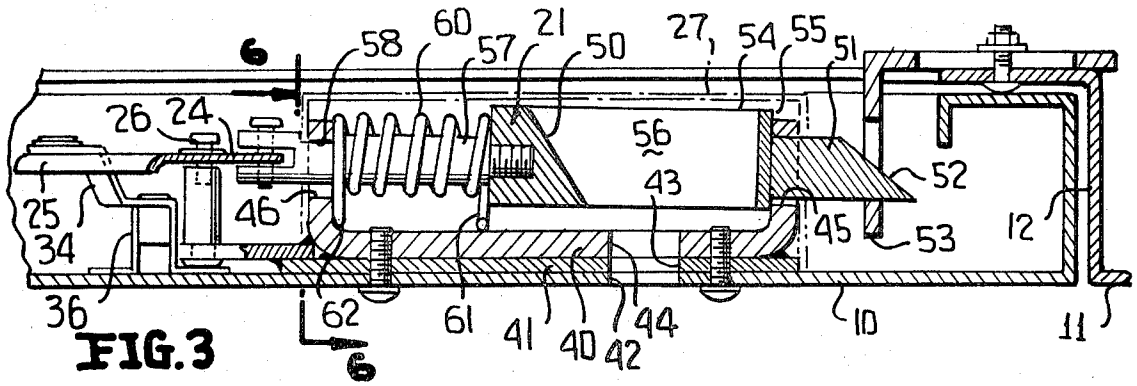


FIG.3

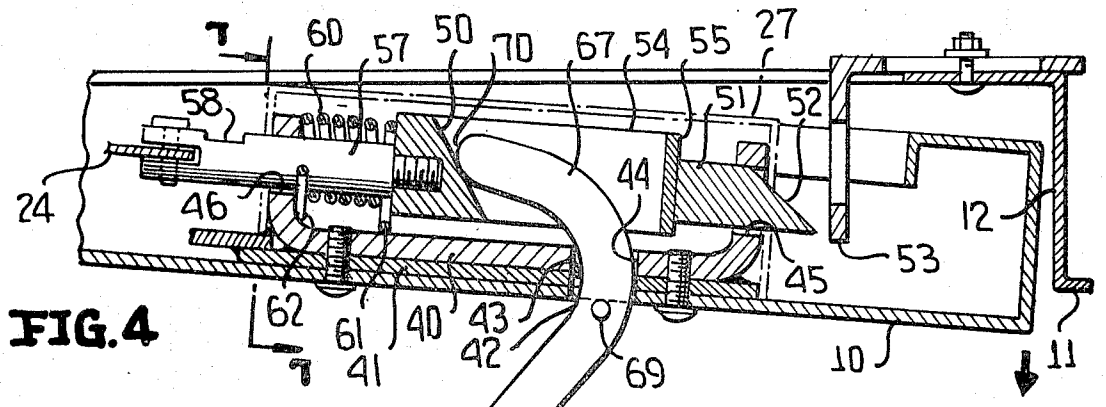
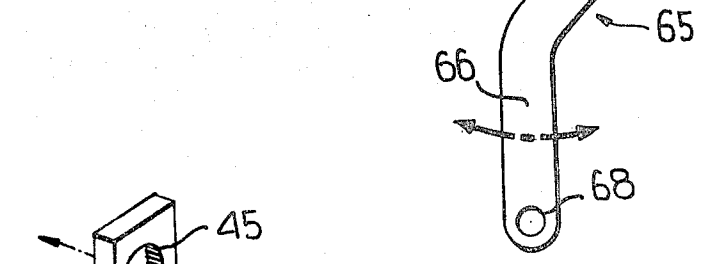


FIG.4



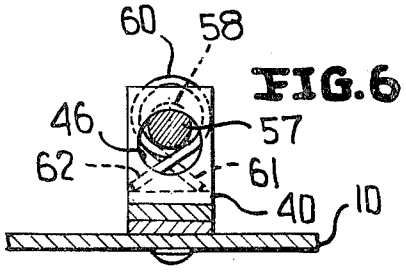


FIG.6

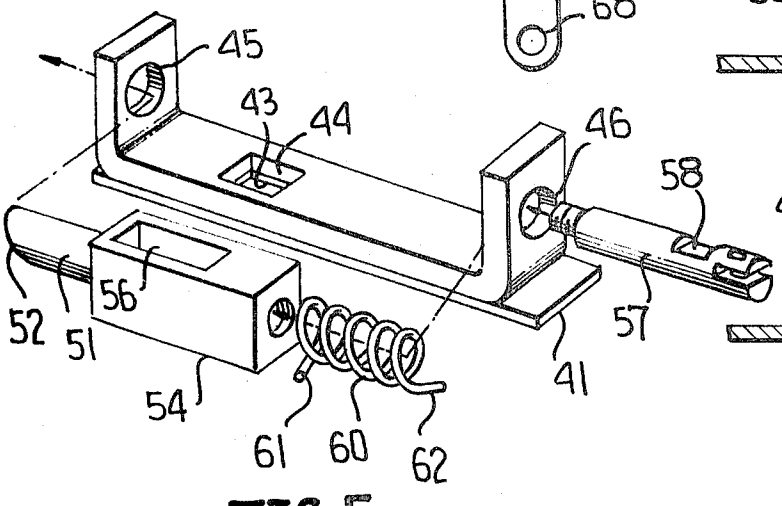


FIG.5

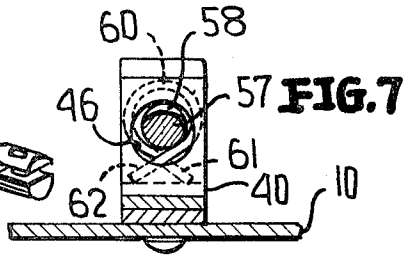


FIG.7

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LOCKING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to locking devices, and more particularly to locking devices for electrical utility cabinets, manhole covers, gratings, and the like. It is to be understood, however, that the locking device of the present invention has broader utility than the uses mentioned above by way of example.

The locking device of the present invention is an improved version of the device disclosed in my U.S. Pat. No. 2,608,085. In that patent I describe a lock of the type wherein a sliding bolt is axially urged into a locking position by a compression spring. The bolt includes an axially extending aperture having an inclined rear wall. The aperture is accessible by means of a relatively short slot through which a combination handle-key member is inserted lengthwise. The handle-key member includes a curbed surface arranged to engage the inclined rear wall of the bolt aperture when a stop in the form of a cross-piece on the handle-key member abuts the slot periphery. When the handle-key member is pivoted about the stop, the curved surface of that member urges the inclined wall of the bolt rearwardly in opposition to the compression spring. When the retracted bolt clears its keeper, the handle-key member is utilized as a handle to pull the lock (and the panel or other closure to which it is secured) in a direction perpendicular to the bolt axis.

The locking device of my prior patent is quite secure and tamper-free. For example, unauthorized personnel utilizing a straight-edge tool into the slot cannot gain the leverage necessary to urge the inclined wall rearwardly against the action of the spring. Moreover, even a properly curved tool, configured to engage the inclined wall of the bolt aperture, would be useless unless it also included a properly positioned stop about which the tool could be pivoted.

In spite of the extremely efficient locking action of the lock of my prior patent, I have found that it may be improved even further whereby inadvertent axial motion of the bolt from its locked position is prevented for all practical purposes. It is therefore one object of the present invention to provide an improved version of the lock of my aforementioned patent whereby the axial restraint of the compression spring is reinforced by an additional restraining mechanism.

Many electric power companies, for the sake of safety and accident prevention, require that locks for enclosures at high voltage field installations contain a three-point locking mechanism. In other words, panels or doors for high voltage cabinets or grating enclosures must be locked securely along at least three sides of the panel or door. Moreover, locks for such utilization must be hazard-proof to the extent that individuals tampering with or attempting to pick the lock should not be exposed to electric shock.

It is therefore another object of the present invention to provide a locking mechanism suitable for high voltage enclosures.

It is still another object of the present invention to modify the locking device of my aforementioned patent to provide a multi-point locking arrangement.

SUMMARY OF THE INVENTION

In accordance with the present invention, the locking device of my aforementioned patent is modified by providing in the bolt a notch which is arranged to engage the rear wall of the lock housing when the bolt is in its lock position. In addition, the compression spring which surrounds the rearward portion of the bolt is spread slightly at its ends to form feet which are compressed against the lock housing. This compression urges the notch into secure engagement with the rear wall of the housing to prevent inadvertent axial movement of the bolt.

In another aspect of the present invention the rearward end of the bolt is arranged to actuate a pivot arm, each end of which is linked to a respective secondary bolt which slides when the pivot arm pivots. The three bolts are positioned at different edges of a closure panel or door to provide a three-point locking arrangement.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a view in perspective of the outside of a hinged door on which the lock of the present invention is mounted, the lock being shown partially in phantom lines;

FIG. 2 is a view in perspective of the inside of the door of FIG. 1 showing the lock of the present invention in greater detail;

FIG. 3 is a view in section taken along lines 3—3 of FIG. 1;

FIG. 4 is a view in section like FIG. 3 but showing the lock of the present invention during actuation;

FIG. 5 is an exploded view of the components of a portion of the lock of FIGS. 1–4;

FIG. 6 is a view in section taken along lines 6—6 of FIG. 3; and

FIG. 7 is a view in section taken along lines 7—7 of FIG. 4.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring specifically to FIGS. 1 and 2 of the accompanying drawings, a panel or door **10** is pivotally mounted by means of hinge **16** at one edge on a cabinet **11** or the like to provide securable access opening for the cabinet. A recessed area **12** in the cabinet wall is configured to receive the panel when closed. Mounted on the inside surface of panel **10** is a three-point locking device configured according to the principles of the present invention. The three-point locking device includes a primary lock **20** and two secondary locks **13** and **14.** Primary lock **20,** which is described in detail below, includes a cover plate **27** (removed in the FIG. **2** view) forming a box-like cover with housing **22.** A bolt **21** is mounted in housing **22** for axially slidable movement in a direction perpendicular to one edge **15** (for example, the vertical edge opposite hinge **16**) of panel **10.** Cover plate **27** is open at its ends to permit bolt **21** to extend both forwardly and rearwardly of housing **22.** When fully extended in its lock position bolt **21** is arranged to engage keeper **23** secured to cabinet **11;** when fully retracted to its open position bolt **21** clears keeper **23.** The rearward end of bolt **21** is bifurcated to receive projecting segment **24** of a pivot arm **25** in a knuckle joint configuration, projection **24** being

rotatable within the bifurcation. Projection 24 is displaced from the center 26 of pivot arm 25, the latter being pivotally mounted at its center on a baseplate 41 secured between housing 22 and panel 10. A linkage arm 30 is pivotally secured at one of its ends to one end of pivot arm 25; the other end of linkage arm 30 is pivotally secured to a bolt 31 which comprises secondary lock 13. Bolt 31 is restrained by bracket 32 to move longitudinally along its axis (vertically in the illustrated embodiment) in response to actuation by pivot arm 25 and linkage arm 30. When fully extended in its lock position, bolt 31 projects beyond the top edge of panel 10 and is arranged to be engaged by a keeper 33. The latter, for example, may comprise an aperture defined through the top wall of recess 12. When fully retracted to its open position bolt 31 clears keeper 33.

A second linkage arm 34 is pivotally secured at one of its ends to the opposite end of pivot arm 25; the other end of linkage arm 34 is pivotally secured to a bolt 35 which comprises secondary lock 14. Bolt 35 is restrained by bracket 36 to move longitudinally along its axis (vertically in the illustrated embodiment) in response to actuation by pivot arm 25 and linkage arm 34. When fully extended in its lock position bolt 35 projects beyond the bottom edge of panel 10 and is arranged to be engaged by a keeper 27. The latter, for example, may comprise an aperture defined through the bottom wall of recess 12. When fully retracted to its open position bolt 35 clears keeper 37.

As will be appreciated from the foregoing, actuation of bolt 21 in primary lock 20 serves to simultaneously actuate bolts 31 and 35 in the secondary locks. More particularly, the lengths of pivot arm 25 and linkage arms 30 and 34 are chosen such that bolts 31 and 35 are fully extended (to their lock positions) whenever bolt 21 is fully extended. Upon retraction of bolt 21, in a manner to be described in detail below, pivot arm 25 is forced to pivot (counterclockwise as viewed in FIG. 2) about center point 26. In so doing, pivot arm 25 pulls linkage arm 30 generally downward and linkage arm 34 generally upward. As a consequence bolts 31 and 35 are retracted. With all three bolts 21, 31 and 35 fully retracted the panel is free to open.

Importantly, pivot arm 25 need not be pivoted about its center, nor must linkage arms 30 and 34 be secured at the ends of pivot arm 25. The only requirement is that the linkages and sizes be arranged such that all three bolts are in their open positions simultaneously and in their lock positions simultaneously.

Primary lock 20 is illustrated in greater detail in FIGS. 3 through 7. Specifically, housing 22 includes a U-bracket 40, the bottom side of which is secured to a base plate 41 which in turn is secured to panel 10. Key access slots 42, 43 and 44 are defined through panel 10, base plate 41 and bracket 40 and are aligned to form an access opening for a key-handle to be described. The opposite upstanding sides of U-bracket 40 are provided with apertures 45 and 46 which are arranged to receive the forward and rearward sections, respectively, of bolt 21.

The forward or latching section 51 of bolt 21 is generally cylindrical and includes a conventional inclined surface 52 arranged to slide along an edge 53 of keeper 23 in a camming operation during closing of panel 10 so that the bolt is forceably retracted until it clears edge 53. Section 51 extends through aperture 45 in the forward leg of U-bracket 40. Immediately rearward of forward section 51 is an enlarged intermediate section 54 of generally rectangular configuration which is disposed between the upstanding legs of U-bracket 40. The transition between sections 51 and 54 is defined by a shoulder 55 which normally abuts the forward leg of the U-bracket but is sufficiently large to prevent passage of section 54 through aperture 45. Intermediate section 54 includes a through-slot or aperture 56 extending along the longitudinal axis of the bolt. The rear wall 50 of slot 56 is inclined in a rearward direction away from the bottom wall of U-bracket 40 in the same manner and for the same purpose as disclosed in my aforementioned patent.

The rearward section 57 of bolt 21 is generally cylindrical and of sufficiently small diameter to extend through aperture 46 in the rearward leg of U-bracket 40. The portion of section 57 which resides forwardly of aperture 46 is surrounded by a helical compression spring 60 which is compressed between the rearward edge of section 56 and the rearward leg of bracket 40. In this manner, bolt 21 is continuously biased toward its extended or lock position by spring 60. The rearward end of section 57 is bifurcated in the manner described above to form a knuckle joint with projection 24 of pivot arm 25. A channel or slot 58 is defined in the upper surface (as viewed in FIGS. 3 and 4) of section 57, cross-wise to the axis of the bolt, and is arranged to engage the rearward leg of bracket 40 and the rearward side of cover 27. More particularly, the width of channel 58 is just slightly greater than the combined thickness of the rearward leg of bracket 40 and rearward side of cover 27. The channel is disposed such that when shoulder 55 abuts the forward leg of bracket 40, channel 58 is aligned with aperture 46. In this position, if section 57 is urged upwardly, or away from panel 10, channel 58 firmly engages the bracket and cover and prevents axial movement of the bolt. The upward urging of section 57 is provided by helical spring 60, the ends of which are uncoiled slightly to provide foot-like members 61, 62 which press against the bottom wall of bracket 40. Feet 61 and 62 thus assure proper engagement by channel 58 when bolt 21 is in its lock position.

Key-handle 65, illustrated in FIG. 4, is specially configured to open primary lock 20. The key-handle is a rod of basically rectangular cross-section having a straight section 66 at one end and curved section 67, somewhat similar to a C-configuration, at its other end. A grip 68 in the form of a cross-bar extends through section 66. The extreme end 70 of section 67 is contoured to provide a cam-like surface for engaging inclined wall 50 in bolt section 54. A stop 69, in the form of a cross-bar, is located at section 67 and serves to limit the extent to which key-handle 65 may be inserted into lock 20.

When bolt 21 is fully extended to its lock position (as illustrated in FIGS. 3 and 6), forward section 51 is engaged by keeper 23 and channel 58 engages bracket 40 and cover 27. Keeper 23 cooperates with bolt 21 in the usual manner to prevent panel 10 from opening as long as the bolt is fully extended. The combined action of the axial force applied to the bolt by spring 60 and the transverse force urging channel 58 into engagement with the bracket and cover prevents any inadvertent axial movement of the bolt.

To open lock 20, section 67 of key-handle 65 is inserted through slots 42, 43 and 44 into aperture 56 as

illustrated in FIG. 4. The key-handle is inserted until end surface 70 contacts inclined wall 50 in aperture 56. The key-handle is then rotated counter-clockwise (as viewed in FIG. 4) so that cam surface 70 pushes against and slides along inclined wall 50. This interaction between cam surface 70 and wall 50 forces the bolt downwardly (as viewed in FIGS. 3 and 4) to clear channel 58 from engagement with the bracket and cover. It also forces the bolt rearwardly (as viewed in FIGS. 3 and 4) and retracts section 51 of the bolt from keeper 23. The key-handle 65 is then pulled in a direction perpendicular to panel 10 (downward in FIG. 4) to swing the panel open. As described above, retraction of bolt 21 effects a similar retraction of bolts 31 and 35 through the action of pivot arm 25 and linkage arms 30, 34.

Closure of panel 10 must also be effected by utilizing key-handle 65. Specifically, once the panel is opened, the bolt is forced forward by spring 60 until channel 58 engages the bracket and cover. To retract the bolt, the key-handle must be employed in the same manner described above for unlocking the panel. When the key-handle retracts the bolt, the panel is pushed until the bolt is aligned with the keeper aperture, at which time pressure on the bolt by the key-handle is released. Spring 60 then forcibly extends the bolt to its lock position. Feet 61 and 62 once again urge channel 58 back into engagement with the bracket and cover to securely close the panel. Of course, as pointed out in my prior patent, if spring 60 fails to function, the bolt may be extended into its lock position by inserting the key-handle 65 such that surface 70 contacts the forward wall of aperture 56 and rotating the key-handle clockwise (as viewed in FIG. 4).

An additional feature of lock 20 is the fact that the only access to any part of the closed lock from outside cabinet 11 is through the key slots. In this regard panel 10 is extended beyond the outermost extension of bolt 21 and then contoured to fit into recess 12. In this manner, there is no exposure of bolt 21 through the open crack between the panel and recess as is present in most doors.

The primary lock 20, described above, has wide utility of itself, apart from the three-point lock combination illustrated in FIGS. 1 and 2. One such utilization is for manhole covers which are readily lifted by the key-handle after the bolt has been retracted. The lock would be secured proximate the periphery of the cover with the bolt arranged to slide in a radial direction toward and away from a keeper secured to the underside of the pavement or structure into which the manhole provides access. Diametrically across the cover from the lock, the periphery of the cover would include a projection arranged to engage the underside of the pavement or structure. This provides a two-point closure using a single lock. To open the cover, the bolt would be retracted by the key-handle which would then be pulled to pivot the cover until the cover projection can be slid clear of the manhole. The cover can then be lifted and removed.

While I have described and illustrated one specific embodiment of my invention, it will be clear that variations of the details of construction which are specifically illustrated and described may be resorted to without departing from the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. A locking mechanism comprising:

a primary bolt having a longitudinal axis and a forward end arranged for latching a keeper structure;

support means supporting said bolt for sliding displacement along said axis;

stop means for limiting the axial displacement of said bolt in one direction; and

bias means for continuously urging said bolt in said one direction;

said bolt having a slot defined therein extending a predetermined distance along the length of the bolt, said slot having an inclined end wall remote from said forward end, said inclined end wall defining a shorter slot length proximate a first side of said bolt than proximate the opposite side of said bolt;

said support means having an entrance opening for a key, said entrance opening being proximate said first side of said bolt in registration with said slot and having a length which is shorter than said shorter slot length;

said bolt additionally including a channel defined in said opposite side of said bolt in a transverse direction relative to said axis, said channel being positioned along said bolt to be in registration with a predetermined segment of said support means when said bolt is displaced to its extreme position in said one direction, the width of said channel being slightly greater than the length of said predetermined segment; and

further bias means for continously urging said bolt transversely in the direction of said opposite side to force said channel to engage said predetermined segment when said bolt is extended to its extreme position in said one direction;

whereby displacement of said bolt opposite said one direction requires a tool having a curved end section to be inserted through said entrance opening and into said slot, said tool to be pivoted to force said curved end section to engage said inclined wall to both disengage said channel from said predetermined segment of said support means and slide said bolt in opposition to said bias means.

2. The locking mechanism according to claim 1 wherein said bias means comprises a helical compression spring coiled about a portion of said bolt and held in compression between a portion of said support means and a portion of said bolt, and wherein said further bias means includes opposite ends of said helical spring extending away from said bolt at said first side of said bolt and into compressed engagement with said support means whereby to urge said helical spring and the surrounded bolt in the direction of said opposite side.

3. The locking mechanism according to claim 2 further comprising:

a pivot arm mounted for pivotal movement about a fixed point;

a secondary bolt having a longitudinal axis and a forward end arranged to latch a secondary keeper structure;

means supporting said secondary bolt for sliding displacement along its axis;

linkage means linking said pivot arm to said secondary bolt to effect sliding movement of said secondary bolt relative to said secondary keeper in response to pivotal movement of said pivot arm; and

means for pivoting said pivot arm in response to sliding movement of said primary bolt along its axis.

4. The locking mechanism according to claim **3** further comprising:

a further secondary bolt having a longitudinal axis and a forward end arranged to latch a further secondary keeper structure;

means supporting said further secondary bolt for sliding displacement along its axis; and

linkage means linking said pivot arm to said further secondary bolt to effect sliding movement of said further secondary bolt relative to said further secondary keeper in response to pivotal movement of said pivot arm.

5. The locking device according to claim **4** wherein said primary and two secondary bolts are mounted on a surface of the same door to provide a three-point closure, said bolts each being extensible beyond a different respective edge of said door.

6. The locking mechanism according to claim **1** further comprising:

a pivot arm mounted for pivotal movement about a fixed point;

a secondary bolt having a longitudinal axis and a forward end arranged to latch a secondary keeper structure;

means supporting said secondary bolt for sliding displacement along its axis;

linkage means linking said pivot arm to said secondary bolt to effect sliding movement of said secondary bolt relative to said secondary keeper in response to pivotal movement of said pivot arm; and

means for pivoting said pivot arm in response to sliding movement of said primary bolt along its axis.

7. The locking mechanism according to claim **6** further comprising:

a further secondary bolt having a longitudinal axis and a forward end arraned to latch a further secondary keeper structure;

means supporting said further secondary bolt for sliding displacement along its axis; and

linkage means linking said pivot arm to said further secondary bolt to effect sliding movement of said further secondary bolt relative to said further secondary keeper in response to pivotal movement of said pivot arm.

8. The locking mechanism according to claim **1** wherein said bias means comprises a helical compression spring coiled about a portion of said bolt and held in compression between a portion of said support means and a portion of said bolt, and wherein said further bias means includes a portion of said helical spring.

9. The locking mechanism according to claim **8** wherein said portion of said helical spring includes at least one end of said helical spring postioned to urge said bolt transversely toward said predetermined segment of said support means.

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