A latch mechanism for a manhole cover in which a rotatable operator member has a threaded portion engaged with a threaded bore in a cam pin which rides in a pair of cam slots in a latching member to cause the latching member to be extended or retracted upon rotation of the operator member in either direction. The threads disengage when the latch member reaches a fully retracted position so that the operating member can freely spin thereafter in the same direction, while the threads reengage when the operator member is rotated in the opposite direction to begin movement of the latch member out of the housing.
LATCH MECHANISM FOR MANHOLE COVER WITH CAPTURED OPERATOR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. provisional application No. 61/527,776 filed on Aug. 26, 2011.

BACKGROUND OF THE INVENTION

[0002] This invention concerns latch mechanisms and more particular lock or latch mechanisms particularly adapted for use in securing manhole covers in place, as described in U.S. Pat. Nos. 7,484,908 and 7,891,904 issued to the present inventor, both incorporated by reference herein.

[0003] The mechanisms described therein use an operating member comprised of a threaded bolt.

[0004] As described in those patents, it is advantageous that the bolt not be allowed to be separated from the mechanism where it could be lost or be dropped into the manhole vault. Also, removal of the bolt by someone tampering with the cover should be prevented.

[0005] While a mechanism for reducing the frequency of separating the bolt is described in U.S. Pat. No. 7,891,904, that mechanism does not positively prevent removal of the bolt from the latch mechanism.

[0006] Accordingly, it is an object of the present invention to provide a latching mechanism in which a threaded operator member such as a special bolt is positively retained within the latching mechanism so as to preclude removal of the member.

DESCRIPTION OF THE DRAWING VIEWS

[0007] FIG. 1 is a fragmentary sectional view of a manhole cover installation having a latch mechanism according to the present invention installed thereon.

[0008] FIG. 2 is an exploded pictorial view of the components of the latching mechanism according to the present invention shown in FIG. 1.

[0009] FIG. 2A is an enlarged pictorial view of the flanged nut and spring shown in FIG. 2.

[0010] FIG. 3 is an enlarged pictorial rotated view of a cam pin and a mating segment of a threaded operator member included in the latching mechanism shown in FIGS. 1 and 2.

[0011] FIG. 4 is a view in partial section of the latching mechanism shown in FIGS. 1 and 2 in the retracted unlatched condition.

[0012] FIG. 4A is an enlarged fragmentary front view of a lower portion of a main threaded portion of the operator member.

[0013] FIG. 5 is a view in partial section of the latching mechanism as shown in FIG. 4 but in the latched extended condition.

DETAILED DESCRIPTION

[0014] In the following detailed description, certain specific terminology will be employed for the sake of clarity and a particular embodiment described in accordance with the requirements of 35 USC 112, but it is to be understood that the same is not intended to be limiting and should not be so construed insasmuch as the invention is capable of taking many forms and variations within the scope of the appended claims.

[0015] Referring to FIG. 1, a portion of a manhole cover 10 is shown, seated over a manhole vault 12. As described in U.S. Pat. No. 7,891,904, the manhole cover 10 normally rests on a radially inward extending rim 14 projecting in a liner 16 forming the vault 12.

[0016] In an explosion, the manhole cover 10 is designed to rise up but only to a limited extent to create a space to controllably vent gases generated by the explosion. A latch mechanism 18 is mounted between a pair of downwardly extending, spaced apart ribs 20 fixed to the underside of the cover 10. A latch member 22 normally projects out radially from a latch housing 24 to engage the underside of the rim 14 to limit upward travel of the manhole cover 10, with other fixed stop features also provided around the perimeter of the manhole cover to keep the manhole cover 10 from tipping as it rises to insure that the manhole cover 10 does not fly free. As described in the above referenced patents, the latching mechanism 18 can be allowed to pivot down when an explosion generates a force sufficient to fracture a shear pin (not shown) in order to allow a greater upward movement of the manhole cover 10.

[0017] The present invention comprises an improvement of the latch mechanism 18.

[0018] The components are shown in FIG. 2 and include the latch housing 24 which slidably receives a cylindrical body portion 26 of the latch member 22, with a sleeve bearing 28 sized to be slidable fit with the cylindrical portion 26 and also itself slidable into a bore 30 in the housing 24.

[0019] The latch member 22 has an engagement portion 32 at its projecting end (at the left in the Drawings), formed with a flat having a series of ribs 34 on its upper surface for engagement with the undersurface of rim 14.

[0020] A threaded elongated operator member here comprised of a bolt 36 has a body portion 37 slidable into a bore 38 extending vertically into the top of the housing 24. A left hand threaded flanged nut 40, compressed wave spring 42 received in a counter bore 45 in the nut flange 43, and washer 44 are received on the threaded bottom stem 46 of the operator member 36, the washer 44 engaging a flange 39 surrounding a bore 38 at the bottom thereof formed in the housing 24 to retain the operator member 36 in the bore 38. The spring 42 keeps the washer 44 abutting flange 39.

[0021] A slight clearance space 41 exists between the washer 44 and the flange 43 on the flanged nut 40 which allows the member 36 to move slightly as described below.

[0022] A lengthwise extending vertical pin 48 in the center of the latch member 22 receives the operator member 36, which passes completely through the slot 48, with the stem portion 46 received in a counterbore 45 extending into the bottom of housing 24, the flanged nut 40, spring 42, and washer 44 placed on the stem 46 and received in the counterbore 45.

[0023] A pair of aligned camming slots 50 are formed in the cylindrical portion 26 of the member 22, each extending from one side of the latching member 22 into the center slot 48 which each receive a respective end of a cam pin 52 which has a central threaded cross bore 54 through which the operator bolt 36 passes with a threaded interengagement between a central threaded section 60 of the operator member 22.

[0024] The operator member 36 has a flanged head 56 for engagement with a wrenching tool to be rotated, the head 54 optionally being of a special shape for security purposes, as described in the above referenced patents.

[0025] To extend the engagement portion of the latch member 22, the operator member 36 is rotated in a direction so that the threaded engagement pulls the cam pin 52 upward which
thus engages the upper wall 58 of each of the slots 50, camming the latch member 22 to the left and causing the engagement portion 32 out of the housing 24, as viewed in FIG. 4.

[0026] Rotation of the operator member 36 in the other direction reverses the motion of the latch member 22, in a direction so as to retract the engagement portion 32 of the latch member until the catch member 22 reaches and abuts the ends of the slots 50.

[0027] The threads of threaded section 60 on the operator member 36 and the threads of the threaded bore 54 of the cam pin 52 pass out of engagement as the operator member 36 moves down slightly allowed by the clearance space 41 and the lowest thread in section 60 pass out of engagement from each other.

[0028] Continued rotation of the operator member 36 in the same direction thus has no effect on the position of the cam pin 52, and the operator member 36 merely spins freely with the contacting threads sliding past each other.

[0029] The section 62 of the operator member beyond the threaded section 60 is machined to a diameter sized to be able to be slidably received in the threaded bore 54 of the cam pin 52.

[0030] The lowest thread 64 on threads section 60 is machined to be square to the axis of rotation, and thus abut the flat face 66 machined on the cam pin 52 (FIG. 3) flattens the uppermost thread in the bore 54. The last thread 64 thus tapers down and its end blends into the diameter of section 62 (FIG. 4A).

[0031] The spring 42 acting between washer 44 and flanged nut 40 urges the last thread 64 of the threaded portion 60 against the uppermost thread in the bore 54, but rotation in the retraction direction has no effect as the first thread in bore 54 and partial thread 64 merely slides over and past each other. There will be a slight clicking sound and motion as the partial thread 64 rides past the flattened first thread in the bore 54.

[0032] The compressed wave spring 42 continues to urge these threads together so that the latch member 32 is held fully retracted.

[0033] When the operator member 22 is rotated in the opposite direction, the thread 64 immediately engages the threads in threaded bore 54 and extending motion of the latch member 22 begins. Thus, cross threading is prevented and proper reengagement is insured.

[0034] Seals 68, 70, 72 may be provided to prevent moisture from entering the mechanism 18.

[0035] Seal 72 is held in recess 71 to the rear of flange 43 on the flanged nut 40.

[0036] The seal 68 normally engages the cylindrical body 26 in service as the latch member 22 is then extended.

Operation

[0037] With the end of the latch member 22 positioned against latch housing wall 18 of latch housing 3, clockwise rotation of operating member 36 causes the thread 60 on operating member 36 to engage threaded bore 54 in cam pin 52. Continued clockwise rotation of operator member 36 advances operator member thread 60 into the threaded bore 54 of cam pin 52 which in turn draws the cam pin 52 upward. This action develops a camming force exerted by the cam pin 52 against upper wall of each of the cam slots 50 formed in the latch member 22. The length of central slot 48 limits the horizontal travel of the latch member in moving from a fully retracted to a fully extended position.

[0038] As a result, the latch member 22 is moved to extend out of latch housing 24.

[0039] Further clockwise rotation of operating member 36 continues until cam pin 52 reaches the end of the cam slots 50 and operating member 22 reaches the end of slot 48. Operating member 22 is torqued to specification, the latch member end 32 now fully extended and locked in that position.

[0040] To retract the end 32 of latch member 22 back into the latch housing 24, operating member 36 is rotated counterclockwise.

[0041] The upper face of the left hand threaded flanged nut 40 is mounted to the threaded end of the operating member stem 46 and is moved towards thrust washer 44 disposed against flange 39 at the bottom of the latch housing 24. Counterclockwise rotation of operating member 36 compresses wave spring 42 against flanged nut 40 and forces cam pin 52 against the lower side of each of the cam slots 50.

[0042] As the cam pin 52 continues to be moved down against the lower sides of slots 50, the latch member 22 is retracted by the camming action of the cam pin 52. The latch member end 32 is fully retracted when the threaded section 60 contacts the right hand end of the slot 48.

[0043] When the latch member 22 is fully retracted, operator member 36 will spin freely, since the threads 60 are then totally disengaged from the threads in the threaded bore 54 as described above.

[0044] Compressed wave spring 42 urges the bottommost thread, 64 of threads 60 against the flattened uppermost thread in thread bore 54 of the cam pin 52. If the operator member 36 continues to be turned counterclockwise, compressed wave spring 42 forces cam pin 52 to the end of slot 48 and fully retracts the latch member end 32 into latch housing 24. Continued counterclockwise rotation of operator member 36 causes a ratcheting sound as the lowest thread rotates past the uppermost thread in bore 54. This assures proper reengagement of the threads 60 and the thread in threaded bore 54 when operating member 36 is again rotated clockwise.

[0045] Operator member 22 can freely rotate in the counterclockwise direction due to the clearance 41 so that operator member head 56 will be raised up and lowered slightly with respect to the latch housing top surface as the operator member 36 is continued to be rotated.

[0046] Accordingly, the operator member 36 remains completely enclosed and captured in the latch mechanism 18 at all times, including when the latch mechanism 18 is being operated and cannot be removed from the housing 24 without a complete removal and disassembly of the latch mechanism 18. No torque specification is needed when retracting the latch member 22.

1. A latch mechanism including a housing with a cavity formed therein in which a latch member is received, said latch member movable lengthwise in said cavity to be extended or retracted to a position a latching end portion thereof protruding from said housing; an operand member received into an opening in said housing and through a lengthwise extending central slot formed in said latch member; said latch member having a pair of aligned angled cam slots formed therein, extending in the same general direction of said extending and retracting motion of said latches, each cam slot lying on either side of said central slot receiving said operand member; a cam pin having a pair of ends each end slidably received in a respective cam slot; said cam pin having a threaded bore formed intermediate said pair of ends, said operand member passing through said threaded bore and
having an external thread engageable with threads of said cam pin threaded bore upon rotation of said operator member in either direction, said operator member restrained against axial movement in said housing so that as said operator member is rotated in either direction said cam pin is moved up or down and in turn acts on the side sides of said cam slots to move said latch member in either an extending or retracting direction of said end portion.

2. The latch mechanism according to claim 1 wherein said lengthwise slot limits the extent of movement of said latching member by abutting either side of said operator member in said respective extended and retracted position of said latching member.

3. The latch mechanism according to claim 1 wherein said threaded portion of said operator member terminates as said latching member reaches a fully retracted position so that the threads on said portion and said threaded bore of said cam pin are disengaged and no further camming action drive occurs.

4. The latch mechanism according to claim 3 wherein said operator member is axially restrained by flanged elements fixed on either end thereof and engaging said housing to limit axial movement in said housing to a slight clearance.

5. The latch mechanism according to claim 4 wherein one flanged element has a resiliently compressed element interposed between said flange and said element to allow limited axial movement and which also urges said threaded portion of said operator member towards said threaded bore, causing said reengagement of said threads of threaded portion of said operator member and said threaded bore in said cam pin upon rotating said operator member in a direction extending said latch member and maintaining full retraction of said latch member with said threads disengaged.

6. The latch mechanism according to claim 3 wherein the last thread of said threaded portion of said operator member is machined squared to an axis of rotation of said operator member to be tapered in width and blended into said operator member.

7. The latch mechanism according to claim 1 further combined with a manhole cover, attached to the underside thereof at the outer perimeter so that said latching member when extended engages a feature on fixed structure surrounding said manhole cover when said manhole cover is installed on a manhole vault.

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