ABSTRACT OF THE DISCLOSURE

A rotary operated latch is disclosed having a cam action in the lever or handle providing a pull-up on the pawl to compress the door or panel against the frame or gasket to provide a tight seal. An over-center action prevents accidental release. The latch has a positive feel providing an indexing signal that the latch has been rotated 90° from the latched to the unlatched position (or vice-versa) with automatic or self-alignment. A tamper-proof feature is also disclosed.

Background of the Invention

This invention relates to door or panel fasteners of the type adapted to be mounted along the edges of doors or panels which overlap a wall or frame. The fastener has a latching finger or pawl which is swingable over the inside frame of the door- or panel-opening to lock the panel against the frame.

Description of the prior art


Summary of the invention

The latch disclosed in the present application has several improvements or features not found in the latches of the prior art. In the first place, the latch of the present application is so designed that accidental release is prevented. Secondly, a positive feel is provided signalling that the latch has been rotated 90° from the latched to the unlatched position (or vice-versa). Thirdly, automatic or self-alignment is provided so that the lever may be properly depressed to cam the pawl in the direction of the panel and provide the type of closure that is desired. Fourthly, the latch has a feature which makes it tamper-proof, in that when used with a lock in which the locking position is the DOWN position, the handle cannot be separated from the shaft without leaving evidence that such separation has occurred. This feature is important when the latch is used on large shipping or cargo containers to seal access doors and panels. If unauthorized access to the container through these panels is attempted, evidence that such attempt has been made is there for the inspector to see. Lastly, the general design of the handle and square-headed sleeve is such that the camming surface of the handle and the mating surface of the sleeve are protected from dirt and weather and are concealed from view to improve the overall appearance of the latch and to disguise the method by which the fastener is operated when the handle is down and locked, thereby to discourage tampering with the latch.

Brief description of the drawing

FIG. 1 is an exploded assembly view of the new latch; FIG. 2 is a plan view of the latch with handle down in latched position; FIG. 3 is a partial view, in section, showing the enlarged elevational view, partly in section, along the line III—III of FIG. 2; FIG. 4 is a partial view, in section, showing the handle partly raised from the DOWM or latched position; FIG. 5 is a partial view, in section, showing the handle in the UP or unlatched position; FIG. 6 is an elevational view of the latch assembly in unlatched position; FIG. 7 is a view, in section, along the line VII—VII of FIG. 6, showing in dot-and-dash line the position of the handle mid-way between the unlatched and latched position; FIG. 8 is a partial elevational view of a modified form of latch the handle of which has a central web, adapted for padlock latching; and FIG. 9 is a view, in section, along the line IX—IX of FIG. 8.

Description of the preferred embodiment

Referring now to the drawings, the latch assembly is shown to include a lever or handle 10, a screw 20, and a sleeve 30. Reference numeral 50 identifies a portion of a door or panel having a hole 51 therein into which the screw 20 and sleeve 30 are inserted. The hole 51 is of a size and shape corresponding to that of sleeve 30. To prevent rotation of sleeve 30 in the hole 51, both the sleeve 30 and the hole 51 are provided with opposing flat sides, identified by the reference numeral 34 for the sleeve and 54 for the hole.

A pawl 40 is provided having therein a hole 41 of a size and shape to receive the shank 23 of the screw 20. To allow axial rotation of the screw 20 (as by the handle 10) to move the pawl 40 rotationally, both the hole 41 in the pawl 40 and the shank 23 of the screw 20 are provided with flat sides, identified by the reference numeral 44 for the pawl and 24 for the screw.

The inward end portion 31 of sleeve 30 is externally threaded for receiving a nut 38 whose function is to hold the latch assembly tightly against the door or panel 50. A pair of nuts 42 and 43 are threaded on the externally threaded shank 23 of the screw 20. Their function is to lock the pawl 40 in its desired position on the screw 20.

The screw 20 has an enlarged nonthreaded center portion 22 of a diameter adopted to be received by the larger bore of the sleeve 30, at the inward or lower end of the sleeve. The outward or head end of the sleeve 30 has a bore 36 of smaller diameter, forming between the larger and bore closer the annular shoulder 35. The nonthreaded upper or head end 21 of the screw 20 is of reduced diameter, relative to the center portion 22, and is of a size corresponding to that of the smaller bore 36 of sleeve 30. A helical spring 37 is placed within the sleeve 30, one end of the spring 37 abutting against the shoulder 35 and the other end abutting against the shoulder 29 formed by the enlarged center portion 22 of screw 20. Thus, spring 37 exerts a thrust against the screw 20 which tends to move the screw 20 inwardly. The extent to which the spring 37 is able to move the screw inwardly is dependent upon, and controlled by, the latch handle 10, as will be described.

Handle 10 is secured pivotally to the head end of screw 20 by a pin 25, which, in a preferred form, is held and supported by a pair of opposed T-shaped bushings 26 and 27. When the bushings 26 and 27, having narrow body and enlarged head, are pressed into the handle 10, flush with the surface of the handle, the bushings cannot be pushed through the handle, and cannot be withdrawn from the handle, without damage to the handle. This design not only provides a tamper-proof feature for the handle to screw assembly but also provides an excellent bearing surface for the pin 25 about which the handle 10 pivots and reduces wear. The design also provides a pleasing appearance to the finished assembly.

The screw 20 is movable rotatably and slidably, relative to the sleeve 30, by the handle 10. The collar spring 37 bearing against the shoulder 35 at one end of the sleeve cavity and against shoulder 29 on the screw 20 at the other end, exerts a thrust which keeps the handle
and the sleeve 30 in constant contact, as will become clear as the description proceeds.

The head end of handle 10, in which pivot pin 25 is mounted, is hollow having a generally rectangular cavity therein which is closed on four sides but is open in the inward and upward directions when the handle is in the DOWN position, as shown in FIG. 1. Mounted within the handle cavity, and shrouded by the side walls of the cavity (which extend beyond the cam members) are two square cam rollers numbered 16 and 17, each having camming surfaces, identified by the suffixes a and b, at right angles to each other, the corner or junction therebetween being slightly rounded. Surfaces of cam members 16 and 17 tend to be in constant touch with the top flat annular bearing surface 39 of the conical section 33 of sleeve 30 due to the thrust developed by the coil spring 37 through the screw 20 to which the handle 10 is pinned. When the handle 10 is pivoted about the pin 25, surfaces of cam members 16 and 17, by bearing on the bearing surface 39 of the sleeve 30, cause the screw 20 to move axially outward through the sleeve 30, thereby allowing a compressive force to be applied through the pawl 40 to pull the panel 50 tightly against the frame or gasket 51.

The sides of the handle 10, extending beyond the cam members 16 and 17, fit closely around three sides of the square head 32 at the head end of the sleeve 30 when the handle 10 is in the DOWN or latched position. When in this position, the extending sides of the handle function like an opened-end wrench, and prevent rotation of the handle 10 so long as it is in the DOWN position.

As mentioned above, sleeve 30 has a conical section 33, preferably 30°, which rises from the square head 32 on the head of the sleeve. The diameter of the conical section 33 at the base of the cone is larger than the width across the square head 32, and that part of the cone which would otherwise extend beyond the square head 32 is cut away, leaving the flat surfaces 133, one of which is seen in FIG. 1. The diameter of the cone 33 at the base is also larger than the inner dimension between opposed extended side walls of the handle 10. When the handle 10 is raised to the UP or "cam away" position, the extended sides of the handle fit closely to but do not extend down over the flat edges of the square head 32 of the sleeve 30. As a result of the structure and relative dimensions just described, when the handle 10 is raised to the UP position, shown in phantom in FIG. 3, and then rotated (relative to the axis of screw 20) to swing the pawl 40 from the latched toward the unlatched position (or vice-versa), the opposed extended sides of the handle 10 are cammed up by the conical surface 33 of the sleeve 30. This is illustrated in FIG. 7. This outward movement of handle 10 pulls screw 20 outward relative to sleeve 30 and compresses the spring 37. This outward movement of handle 10 lifts the cam members 16 and 17 away from the top flat annular bearing surface 39 of the sleeve 30 until the extended sides of the handle encounter a diameter on the sloping surface of the cone 33 equal to the inner dimension between the said extended sides. When this diameter is reached, the lifting action ceases, and the extended sides of the handle thereafter rotate about the cone 33, all the while bearing down upon the sloping wall of the cone 33 under the action of the thrust of the spring 37. This continues, as the operator continues to turn the handle 10, until complete release is made. The extended sides of the handle 10 meet the flattened portions 133 of the cone section 33 and again make with the flat sides of the square head 32 of the sleeve 30. At this point, the extended sides of the handle are clear of the edges of the square head 32, and the handle 10, under the urging of the spring 37, snaps into the same square surfaces 16 and 17 of the handle 10 again encounter the top flat annular bearing surface 39 of the sleeve 30. The handle is now exactly oriented in the unlatched (or latched) position 90° distant from the position where rotation began. The act of unlatching positions the pawl 40, retaining it in this position against axial movement, but it also aligns the handle 10 so that the extended sides will rest properly around the square head 32 of the sleeve 30 when the handle is pinned into the DOWN or "cam in" position, to complete the panel latching action.

It will be understood that when the handle 10 is raised from the DOWN or latched position to the UP or unlatched position (or vice-versa) the camming action of the cam members 16 and 17 causes the cammed surfaces 16a and 16b of the sleeve 30 to be cammed up over the flat surface 39 of the sleeve 30 during this camming action, a point is reached where the junction of camming surfaces 16a and 16b, and the junction of camming surfaces 17a and 17b are in line with the center axis of pivot pin 25. This point is the "dead center" position of the two 90° displaced cam surfaces a and b of cam members 16 and 17. On either side of this dead-center point, the thrust from the spring 38 creates a force moment, and as a result the screw 20 is urged inwardly, and handle 10 moves in the direction from top dead center to which it is displaced. This provides an over-center action with directions and as a result the handle 10 in DOWN position tends to stay down, and in UP position tends to stay up. Thus, handle 10 cannot vibrate open. It cannot fall into the opposite position from which it is placed without overcoming an increase in force, as the spring moves to maximum load position when the handle 10 moves through the dead center position.

The camming surfaces 16b and 17b of cam members 16 and 17, and the sides of the holder which extend beyond these surfaces, are more distant from the center axis of pivot pin 25 than are the other camming surfaces 16a and 17a and the other side walls. Thus, when the handle is in the DOWN position, as shown in solid line in FIG. 3, and the camming surfaces 16b and 17b are bearing against the annular bearing surface 39 of the sleeve 30, the side walls of the holder embrace the square head 32 of the sleeve and pin 25 is more remote from the panel 50. The pawl 40 is then in the position shown in solid line in FIG. 3. This is the latched position. When the handle 10 is raised to the UP position, as shown in phantom in FIG. 3, the nearer-to-the-pin camming surfaces 16a and 17a bear against the annular bearing surface 39 of the sleeve 30, the side walls of the holder do not embrace the square head 32 of the sleeve, and the pivot pin 25 takes the position shown in phantom in FIG. 3. This position of pin 25 is substantially closer to the panel 50, and the screw 20 and pawl 40 are in the unlatched actions shown in phantom in FIG. 3. This is the unlatching position of the pawl, from which the pawl is turned angularly 90° by the handle 10.

Before referring to a modification illustrated in FIGS. 8 and 9, the illustrations in FIGS. 1–7 will be briefly reviewed. FIG. 1 is an exploded view of the latching assembly, and includes a portion of a panel 50. In FIG. 1, the handle is shown in the DOWN or latched position. FIG. 2 is a plan view of the latch, the handle being down in the latched position. FIG. 3 is a side view of the latch, enlarged, and in section. FIG. 4 shows the handle in between the latched and unlatched positions. FIGS. 5 and 6 show the handle in UP or unlatched position. FIG. 7 shows, in phantom, the handle rotated (axially relative to the axis of the screw 20) to bring out how the sides of the handle cavity are cammed up on the conical section 33 of the sleeve 30 as the handle is rotated to rotate the pawl.

FIGS. 8 and 9 illustrate a slight modification which adapts the latch for padlock locking. The latching mechanism in FIGS. 5–9 is the same as has already been described with reference to FIGS. 1–7, but the handle 10 is provided with a center web 18 having a hole therethrough. A bracket 60 having a pair of apertured prongs
61, 62 is secured, as by rivets, to the panel 40 in such position, relative to the latch, that when the handle 10 is in the DOWN position, the hole 19 in the web 18 is in alignment with the holes in the prongs 61, 62 of the bracket 60. The padlock 65, shown in phantom, is then inserted, as illustrated.

Other configurations than those shown and described could, at course, be used. For example, the bushings 26 and 27 for pin 25 need not have the enlarged head, the handle 10 could be differently shaped or proportioned, the sleeve 30 could be differently proportioned, and the spring 37 could be outside the sleeve 30 and bear on one of the flats 42, 43. Other modifications within the scope and spirit of the appended claims will occur to those skilled in the art.

What is claimed is:

1. A latch assembly having a pull-up action for developing a compressive force between two closure members which are to be pressed together, said latch assembly comprising:
   (a) a sleeve adapted to project through a hole in one of said closure members and to be secured non-rotatably therein, said sleeve having a square head and a frusto-conical cap on said square head, the diameter at the base of said conical cap being larger than the diameter of the square head, the portion of said conical cap which would otherwise project beyond said square head being cut off, the outward surface of said cap forming a flat annular bearing surface;
   (b) a screw through said sleeve and movable axially and rotatably with respect thereto, said screw having a head portion extending outwardly beyond said sleeve and a threaded shank section extending inwardly beyond said sleeve, said inwardly extending shank being adapted to support a pawl for inward and outward movement with said screw and for angular movement with said screw;
   (c) a handle pivotally pinned by a pivot pin to the outwardly extending head portion of said screw, said handle having a generally rectangular cavity through which the pivot pin passes;
   (d) a pair of rectangular cam members within said cavity, one on each side of the screw head, said cam members secured to the side walls of said handle, said pin passing through said side walls of the handle and through the cam members substantially closer to one edge of each than to the edge at right angles thereto, one or the other edges of said cam members tending to bear against the flat annular bearing surface of said conical cap, the side walls of said handle which define said cavity extending beyond said cam members;
   (e) said pivot pin being so located relative to said cam-

2. A latch according to claim 1 characterized in that said conical cap has a slope of the order of 30°.

3. A latch according to claim 1 characterized in that:
   (a) said sleeve has a smaller bore at the outward end and a larger bore at the inward end, forming an annular shoulder therebetween;
   (b) said screw has a center section within said sleeve which is larger in diameter than the head portion of said screw, forming a shoulder therebetween;
   (c) said resilient means is a coil spring disposed between said sleeve shoulder and said screw shoulder, said spring tending to thrust said screw inwardly.

4. A latch according to claim 3 characterized in that the ends of said pivot pin are supported in said handle in a pair of bushings.

5. A latch according to claim 4 characterized in that said conical cap has a slope of the order of 30°.

6. A latch according to claim 1 characterized in that said handle, beyond the cavity portion, is provided with a web portion having an aperture therethrough for receiving the shackle of a padlock, said latch being adapted to cooperate with a fixed bracket on said one closure member to effect locking said closure members together.

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